
Plymouth- Carver Sole Source Aquifer: Regional Open Space Plan

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INTRODUCTION

The second largest sole source aquifer in Massachusetts, the Plymouth-Carver Sole Source Aquifer (the Aquifer) covers 140 square miles underlying the towns of Plymouth, Carver, Kingston, Wareham, Plympton, Middleborough, and Bourne. The Aquifer contains over 500 billion gallons of fresh water (USGS 1992), and serves as a critical water resource for residential, commercial, and agricultural uses in the area. Though its resources are vast, they are not unlimited, nor are they unaffected by contamination.

On August 7, 1990, the Environmental Protection Agency (EPA) released a notice announcing that the Plymouth-Carver Aquifer satisfies all criteria for designation as a sole source aquifer. Specifically, the EPA recognizes that the Aquifer is the only source of drinking water for many residents in the area, that there are no alternative sources of water in the area that could meet the demand, and that contamination would create a public health hazard and financial burden (EPA 1990).

In 2006, the Massachusetts legislature charged the Executive Office of Energy and Environmental Affairs (EEA) to work with designees from each of the seven towns in the Aquifer region in order to develop a plan for protecting their shared resource from depletion and contamination. This plan, the Plymouth-Carver Sole Source Aquifer Action Plan (PCAAP), was released in 2007. Stressing the importance of home rule, the PCAAP lays out recommendations for towns to work together to protect the Aquifer. The four primary focus areas of the PCAAP are: (1) Policy, (2) Coordination and technology transfer, (3) Outreach for target audiences, and (4) Grants and funding (Fuss & O'Neill 2007).

The recommendations of the PCAAP articulate the importance of open space planning as a tool to protect the Aquifer, stating, "To enhance existing municipal open space protection efforts, municipalities of the Plymouth-Carver Aquifer Advisory Committee (PCAAC) should work together to develop an areawide open space protection plan. An areawide plan will foster the development of clear priorities for the [Aquifer] and will help to maintain the integrity of existing intermunicipal open space tracts. An areawide plan will also increase the likelihood of receiving financial assistance from the state" (Fuss & O'Neill 2007, p.5).

In 2007, the Massachusetts legislature appropriated additional funds to assist Aquifer communities in implementing the recommendations of the PCAAP. As a result, the Executive Office of Energy and Environmental Affairs contracted with the Urban Harbors Institute (UHI) to develop this regional open space plan for the Plymouth-Carver Sole Source Aquifer. Working closely with members of the PCAAC, town officials, and members of the public, this plan provides a series of recommendations to help guide the towns of Plymouth, Carver, Wareham, Kingston, Plympton, Bourne, and Middleborough in making open space decisions that protect the quality and quantity of water in the Aquifer and encourage collaboration on a regional scale.



Figure 1--Aquifer Boundary and Aquifer Communities

For the purposes of this plan, the term “open space” includes all lands that are predominantly undeveloped such as forests, fields, wetlands, and those with surface waters. Agricultural lands and recreational fields are also included in the definition. While some would argue that a cranberry bog or a golf course is not “open space”, these land uses are typically “undeveloped” in terms of structures and truly impervious surfaces, making them (1) more suitable for acquisition and conversion to a more “natural state”, and (2) generally capable of providing some aquifer recharge benefits. Additionally, this plan recognizes the fact that “open space” can be created by converting an existing land use (a grocery store for example) into a more natural land use.

The term “unprotected open space” herein refers to lands that do not currently have any level of conservation ownership or protection. The term “protected open space” herein refers to land that is held for conservation purposes by the municipal, state, or federal government, or a non-profit organization. In addition, the term “protected open space” also applies to land subject to a permanent conservation restriction or agricultural preservation restriction.

Chapter 61, 61A, and 61B lands refer to land enrolled in a temporary real estate classification system which, under certain circumstances, gives municipalities rights of first refusal to acquire those lands.

PLANNING CONTEXT

This section briefly describes the natural and political resources of the seven towns overlying the Aquifer.

Geology of the Aquifer

During the Winsconsin glaciation which occurred approximately 25,000 years ago, all of Southern New England, including the Aquifer region, was covered by a glacier (Fuss & O’Neill 2007). The Aquifer is primarily made up of deposits from this glacier “that are saturated with water” (USGS 1992, p. 13). Glacial activity influenced not only soil composition, but also the landscape and topography of the region, creating kettles, moraines, and jagged coastlines (Fuss & O’Neill 2007).

Soil type within the Aquifer region is influenced by bedrock type, glacial deposits, and post-glacial deposits. Bedrock is located below the soil and impacts soil development and water flow (Fuss & O’Neill 2007). There are two types of bedrock found in Plymouth County: crystalline igneous and metamorphic rock (Fuss & O’Neill 2007). Crystalline rocks are found deep below the surface in the southeastern part of the Plymouth County, while metamorphic rocks are found at more shallow depths in the northern part of the County and in the Town of Lakeville (Fuss & O’Neill 2007).

Deposits from this glacier, such as till, fluvial, ice-contact, and lacustrine, create soil substratum, a material used for soil formation (Fuss & O’Neill 2007). Soils from glacial deposits “are very permeable and support a rapid recharge of groundwater” (Fuss & O’Neill 2007, p. 24). Till, which is made up of “clay to boulder size particles,” is left behind during glacier advancement, primarily covers morainal areas, and has varying degrees of permeability (Fuss & O’Neill 2007, p. 24; USGS 1992, p. 7). Fluvial and ice-contact deposits are created when ice melts during the glacial retreat phase, resulting in rivers that leave behind sand and gravel. In the Aquifer region, these soils are found in three outwash plains, as well as Kame and kame deltas north of Ellisville (USGS 1992). Lacustrine sediments, consisting of silts, clay and fine sand, are a result of glacial lakes that occurred briefly after the glacier retreated, and have low levels of permeability (USGS 1992; Fuss & O’Neill 2007). In the Aquifer region, these soils are located west of Pine Hill, as well as at the southern tip of Carver pitted plain (USGS 1992).

Post-glacial deposits began settling when the glacier retreated about 10,000 years ago, and consist of eolian, organic, alluvial, and human-related deposits (Fuss & O’Neill 2007). In New England, eolian mantles are commonly found in upland soils, are about 10 to 40 inches thick, and are composed of wind-blown silt and sand that create a layer on top of the previously discussed “Glacial deposits” (Fuss & O’Neill 2007). Organic deposits are made up of both freshwater and saltwater sediments and settle in “open water and lowland positions on the landscape” (Fuss & O’Neill 2007, p. 25). Alluvial deposits are found in floodplains where they were left behind by rivers and streams, and are not very common in the Aquifer region (Fuss & O’Neill 2007). Human-related activities, such as construction, bulldozing, rock blasting, and excavation and removal of sand and gravel also create disturbances and deposits that influence the soil composition in the Aquifer region (Fuss & O’Neill 2007).

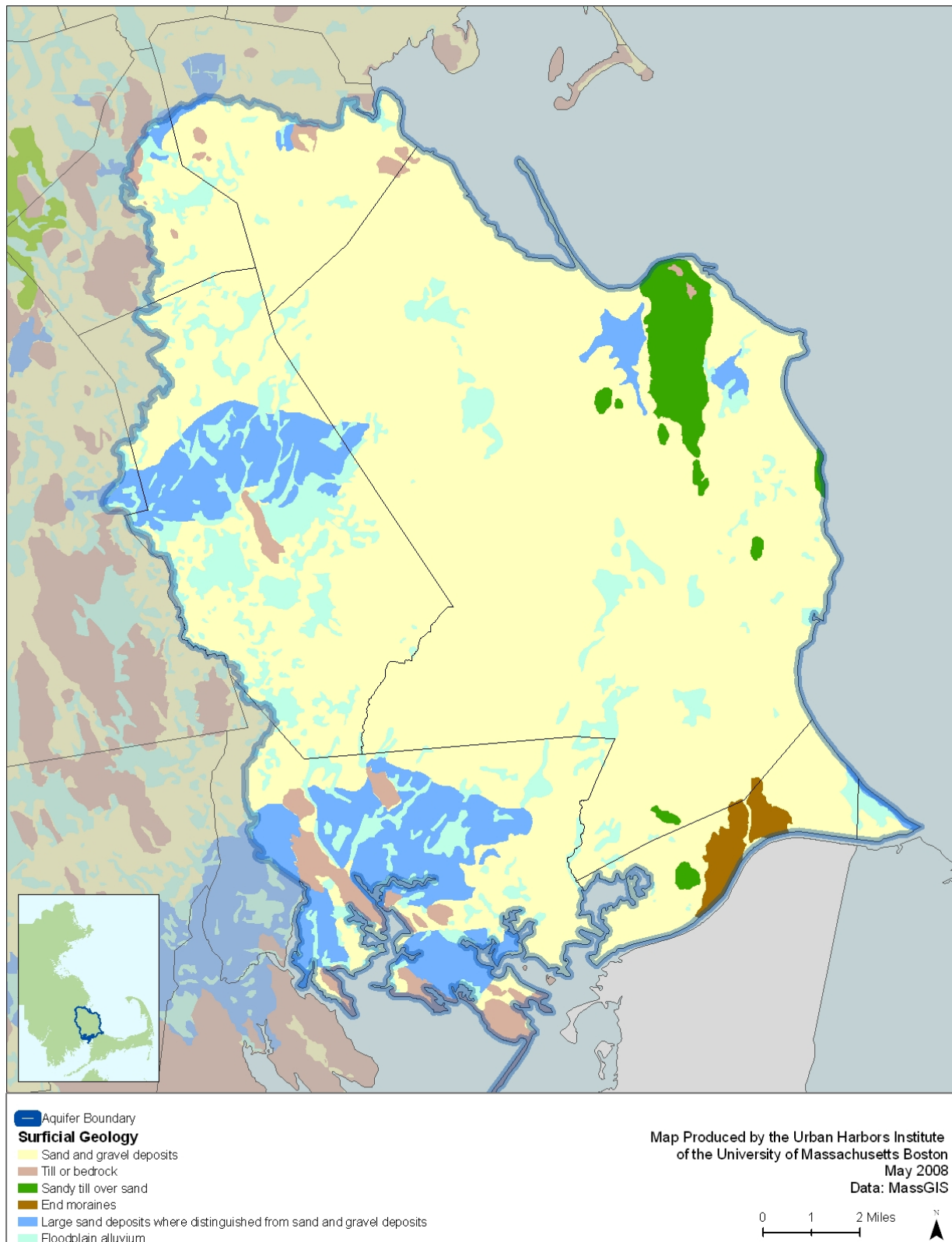


Figure 2—Surficial Geology

Regional Background

Over half of the Aquifer region is undeveloped woodland and shrubland, wetlands, and surface water, while the rest of the land is used for residential, industrial, urban and agricultural developments (USGS 1992). Over the last 190 years, cranberry growing has been a major industry in the region. While the industry is strong now, economic hardships led many cranberry growers to sell off some of their uplands for development starting at the end of 1999 (Brian Wick, personal communication, 2008).

As previously mentioned, the Aquifer is the major source of water for southeastern Massachusetts. In 1985, the aquifer supplied an average of about 59.6 million gallons a day (USGS 1992). That number is likely to be much higher now, given the increase in population in the area over the last twenty years. In 1990, the US EPA characterized the water in the Aquifer as *good to excellent*, but noted that the Aquifer region has very porous soils and high groundwater, making it more vulnerable to contamination (Fuss & O'Neill 2007). This contamination is primarily a result of the "recharge" of the Aquifer through precipitation, which in turn may "flush chemicals and other constituents (from shallow soils) into the water supply" (Fuss & O'Neill 2007, p. 27). These contaminants consist of oils, fertilizers and other materials that are released on shallow soils (Fuss & O'Neill 2007). The likelihood of water contamination is also dependent on the type of soil and its respective permeability (Fuss & O'Neill 2007).

Since 1970, the towns located above the Aquifer region - Plymouth, Carver, Kingston, Wareham, Plympton, Middleborough, and Bourne - have experienced large population increases (USGS 1992). For example, the population of Plymouth increased from 18,606 to 51,701 between the years of 1970 and 2000 (Town of Plymouth, 2004). This rise in population has resulted in an increase of both commercial and residential development, enhancing the demand for water as well as the potential for water contamination.

Plan Review

Some aquifer-related issues, such as population growth and water conservation strategies, are addressed in various plans written on both town and regional scales. Although these towns are experiencing some similar changes, share some similar characteristics, and have some similar goals, each town has, at least in the case of open space planning for the sake of the Aquifer, expressed the importance of home rule. In other words, towns are not interested in any new layers of government or regional resource management entities. Without a regional open space committee focused on protection of the Aquifer, each individual municipality will be responsible for executing the recommendations of this plan. To that end, it is important that the recommendations in this plan are consistent with and reinforce - or at least do not conflict with - the goals and visions of each municipal master plan and open space and recreation plan. In addition, understanding communities' needs, goals, and action items is important when identifying ways for the towns to work together on a regional scale.

Open Space and Recreation Plans

Open space and recreation plans exist for each of the seven municipalities overlying the aquifer. The following open space and recreation plans—some dated and others in draft form—were reviewed for each town.

Table 1 – Open Space and Recreation Plans Reviewed

Towns	Town Open Space & Recreation Plans
Plymouth	2004 - Complete and current
Plympton	2008 Draft in progress
Middleborough	1998-2003 – Expired
Wareham	2004-2009 - Complete and current
Carver	2004-2009 - Complete and current
Bourne	1997-2002 - Expired; Draft in progress
Kingston	2001-2006 – Expired

Importantly, all open space and recreation plans recognize the need to acquire and protect open space for the sake of drinking water quality and/or quantity, as reflected in the following selected goals and actions:

- Plymouth Goal: “Protect the sources of drinking water supply in Plymouth through the use of open space conservation and management.” (Town of Plymouth 2004)
- Carver (Goal II, Objective 1b): “Protect land (especially land over the Plymouth-Carver aquifer) by purchase or conservation restrictions, using state and federal funds whenever possible and assistance from land trusts.” (Town of Carver 2004)
- Kingston (Goal 2, Objective B): “Ensure that local land use control powers are used to the fullest extent possible to protect the quality of present and future public water supplies.” (Town of Kingston 2001)
- Middleborough Objective: “Acquire by gift, purchase, conservation easement, or conservation restriction, land to protect well heads, particularly land adjacent to well heads.” (Town of Middleborough 1998)
- Bourne Action Item: “Make full or partial purchase of land rights within the Water Resources Protection Districts a priority.” (Town of Bourne 1997)
- Plympton (Goal 1 Objective): “Determine the significance of town holdings to ground water protection. Use this information to set priorities for acquisition and development of management principles.” (Old Colony Planning Council 2008)
- Wareham (Objective 1b Action Item): “...Permanently protect...a 1,100-acre parcel of land located in Zone 2 of the Plymouth-Carver Aquifer by (a) purchasing the land outright and adding it to the Miles Standish State Forest; or (b) purchasing the development rights for this land and maintaining it for agricultural uses.” (Town of Wareham 2004)

While each of the plans is concerned with protecting drinking water through open space preservation and acquisition, this concept is not the only priority for the towns. Most are focused on preserving the natural and/or historical feel of their towns as well as increasing recreational opportunities.

In addition, the need to protect the Plymouth-Carver aquifer is not the highest priority in all towns. Middleborough, for example, has very little land overlapping the aquifer and currently draws no water from the resource. In fact, the Middleborough plan makes no specific mention of the aquifer at all. Wareham’s plan gives greater attention to protecting coastal resources and developing recreational opportunities than to protecting drinking water. It is interesting to note however that, in a survey

conducted in association with their Open Space and Recreation Plan, Wareham residents gave top priority to protecting drinking water supplies via the acquisition of land in aquifer watershed.

Perhaps the most useful information these open space and recreation plans provide for this regional plan are lists of existing protected and unprotected open space, Chapter 61, 61A, 61B lands, and lands under consideration for future acquisition. These lists, in combination with aquifer data and GIS resources, provide guidance on where to focus on open space protection and acquisition. As the quality and availability of data in the open space and recreation plans varies from town to town, efforts have been made to acquire the most current and complete data from other sources when available.

Table 2 – Elements of Open Space and Recreation Plans

Town	Existing Open Space	CH 61, 61A, 61B Lands	Future Acquisitions
Plymouth	Includes an inventory of Open Space and Recreation Lands with map and lot #s for most. Not all are listed as protected or unprotected	No list (plan recommends that the Open Space Committee develop one)	Plan provides ranking system, but no list.
Carver	Yes - Protected and Unprotected (p.58) Descriptions, no parcel #s	No list (A list is under development, and parcels should become considerations for open space planning)	Not in plan, but UHI has list. Numbers on list do not match MassGIS parcel data
Kingston	Described in the plan appendix with map and parcel #s	Yes -- in appendix with map and parcel numbers	Described in the plan (No parcel #s)
Plympton	Described in the plan (p. 50) with map and parcel #s	Yes -- with map and parcel numbers (p. 59)	Described in the plan (With parcel #s)
Wareham	Described in the plan (p. 45) with map and lot #s	Yes (as of 2003) -- with map and lot #s (p. 59)	No
Bourne	Described in the plan appendix with map and parcel #s and mapped	Described in the plan appendix with map and parcel #s and mapped	Described in the plan appendix with map and parcel #s and mapped
Middleborough	Described in the plan. No parcel #s.	No	No (plan recommends acquiring some of the identified unprotected existing open space

A more detailed review of community needs statements, goals, objectives, and actions can be found in the Open Space Plan Review Document in Appendix D.

Municipal Master Plans

Municipal master plans (also known as local comprehensive plans, plans of development) are statements of the desired future physical growth of a community. These plans include all major dimensions of community's development and growth including economic development, land use; housing; historic, cultural and recreational resources; open space; transportation; and infrastructure.

Most plans establish goals and policies for each element in the plan, with particular attention to the relationships and interdependencies of the topics. As the name implies, the plan's strength and significance is in the comprehensiveness of its analyses and scope. The plan's recommendations regarding open space preservation and natural resource protection are generally a complement to its recommendations related to economic and land development, i.e., land areas are identified as either being suitable for some degree and type of development or appropriate for protection. The master plan's open space goals are usually consistent with those of the community's Open Space and Recreation Plan, though there may be a difference in objectives and priorities.

An effective master plan will outline specific implementation mechanisms for each of its recommendations: regulatory, funding, or programmatic.

Table 3 – Town Master Plans Reviewed

Towns	Plan
Plymouth	Strategic Action Plan 2004
Plympton	No existing plan
Middleborough	Community Development Plan 2004
Wareham	Master Plan 1998
Carver	Master Plan 2001
Bourne	Local Comprehensive Plan 2005
Kingston	Master Plan 1998

Each of the master plans reviewed for the communities overlaying the aquifer recognize in some manner the importance of water resources and the benefits of protection open space. As there are no statewide guidelines or direct financial incentive as exist for Open Space and Recreation Plans, master plans tend to vary more widely in framework and approach reflecting local conditions, issues and priorities.

Examples of goals, policies and actions related to water resources and open space protection from area master plans:

Carver:

Continue to maintain a high ratio of open space to developed land for the protection of environmental resources, scenic character, and the economic health of the town.

Identify and protect environmentally sensitive areas, including areas along ponds and rivers, water recharge areas such as cedar swamps, parcels that impact potential public water supplies, and scenic areas as well as trails and areas needed by the town and region for recreation.

Plymouth:

Establish natural resource and open space and cultural heritage networks (Green, Blue and Cranberry Networks).

Protect and enhance the Blue Network of inland and coastal water resources, including wetlands and aquifer connections.

Protect the quality and quantity of groundwater and surface water.

GOALS AND RECOMMENDATIONS

This section describes the goals and recommendations of the plan, along with information to help clarify the purpose and intent of the recommendations.

GOAL: To acquire and/or protect open space for the purpose of protecting the quality and quantity of water in the Aquifer.

Recommendation #1

When making decisions about open space acquisition, towns and land protection agencies should make aquifer protection a priority. A ranking system and series of maps (see Appendix A) have been developed to assist with this recommendation.

Recommendation #2

Towns should identify sites for potential wells and work to protect the surrounding land. At the minimum, towns should apply a hypothetical Zone I Wellhead Protection Area to each potential well site to increase the chances of having a protected recharge area for the future well. Towns may also consider applying a hypothetical Interim Wellhead Protection Area (IWPA) to potential wells. Maps have been developed for each town to identify potential well sites. (See Appendix B)

A regional open space plan for the Plymouth-Carver Aquifer must first and foremost focus on lands that are important to the quality and quantity of water in the Aquifer.

The amount of water in an aquifer depends on the amount of water pumped out of the aquifer and the amount of water recharged into the aquifer. Open space planning is important to the amount of water in the aquifer in several ways:

- Open space planning could direct the types of or limit the amount of development, reducing the need to draw out additional water on a town or regional scale
- Open space planning could limit the amount of impervious surface allowed in important or potentially important recharge areas, thus allowing the water to seep into the aquifer rather than travel over and out of the aquifer

Table 4 – Recharge Rates Based on Land Use

Land use	Mean final infiltration rate(inches/hour)	Recharge rates (relative to highly disturbed and compacted lawns)
Forest (undisturbed)	12.40	62.00
Slightly disturbed woodlands	4.40	22.00
Former farmland	1.90	9.50
Disturbed and revegetated lawns	0.50	2.50
Highly disturbed lawns	0.30	1.50
Highly disturbed and compacted lawns	0.20	1.00

(Table taken from Heath, 1994, p.38)

The quality of water in an aquifer depends on many factors such as the aquifer’s ability to filter water and the presence or lack of contaminants. Open space planning is important to water quality in several ways:

- Open space planning can provide protective buffers to areas such as kettle ponds where surface waters connect directly to the aquifer
- Open space planning can help direct development to already developed areas, helping to leave undeveloped areas as pristine as possible
- Open space planning can minimize certain types of potentially harmful land uses within important recharge areas, thus decreasing the chances of contamination as water filters through the sediment and is drawn up through a well.

While this regional open space plan focuses on ensuring the health and supply of the Plymouth-Carver Aquifer, open space planning can also provide other benefits such as habitat protection, recreational opportunities, scenic views, and preservation of town character.

The State recognizes the importance of protecting land for the sake of water quality and quantity. Using sediment information and hydrologic models, the Massachusetts Department of Environmental Protection (DEP) has identified recharge areas around wells and wellfields that are critical to protecting groundwater, and thus the quality of drinking water extracted at wells. There are four different categories of these wellhead protection areas (Zone I, Zone II, Zone III, and Interim Wellhead Protection Areas) defined in the State’s Drinking Water regulations (310 CMR 22.02). These wellhead protection areas are described below:

Zone I

“...The protective radius required around a public water supply well or wellfield. For public water system wells with approved yields of 100,000 gpd or greater, the protective radius is 400 feet. Tubular wellfields require a 250-foot protective radius. Protective radii for all other public water system wells are determined by the following equation: Zone I radius in feet = (150 x log of pumping rate in gpd) - 350. This equation is equivalent to the chart in the Guidelines and Policies for Public Water Systems. A default Zone I radius or a Zone I radius otherwise computed and determined by the Department shall be applied to transient non-community (TNC) and non-transient non-community (NTNC) wells when there is no metered rate of withdrawal or no approved pumping rate” (310 CMR 22.02).

Approved Zone I areas of a well, wellfield, or spring must be owned or controlled by whomever is supplying the water. Furthermore, all existing and planned land uses must either have a direct relationship to providing water, or must not have “no significant adverse impact on water quality”.

The August 2003 Source Water Assessment and Protection (SWAP) Report for Plymouth makes an important point that some public water supplies were developed prior to the Zone I regulations, and contain non-compliant activities such as power lines, gravel mining operations, and private residences (Massachusetts Department of Environmental Protection, 2003, page 3).

Zone II

“...That area of an aquifer that contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at approved yield, with no recharge from precipitation). It is bounded by the groundwater divides that result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone II shall extend upgradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary). The Zone II must include the entire Zone I area. For springs, the Zone II is that area of an aquifer, which contributes water to the spring under naturally flowing conditions” (310 CMR 22.02).

Activities within a Zone II must adhere to the land use guidelines described in 310 CMR 22.21(2)(a) and 310 CMR 22.21(2)(b), such as prohibiting junkyards, landfills, hazardous waste storage facilities, and other types of facilities that could lead to contamination. Furthermore, land uses must comply with the nitrate management requirements of 310 CMR 22.21(2)(d) which aim to prevent nitrate contamination by ensuring nitrate levels below five mg/l.

Activities within Zone II areas are also subject to the town’s Aquifer Protection District bylaws.

Zone III

“...That land area beyond the area of Zone II from which surface water and groundwater drain into Zone II. The surface drainage area as determined by topography is commonly coincident with the groundwater drainage area and will be used to delineate Zone III. In some locations, where surface and groundwater drainage is not coincident, Zone III shall consist of both the surface drainage and the groundwater drainage areas” (310 CMR 22.02).

As with Zone II areas of wellhead protection, activities within a Zone III must adhere to the land use guidelines described in 310 CMR 22.21(2)(a) and 310 CMR 22.21(2)(b), such as prohibiting junkyards, landfills, hazardous waste storage facilities, and other types of facilities that could lead to contamination. Furthermore, land uses must comply with the nitrate management requirements of 310 CMR 22.21(2)(d) which aim to prevent nitrate contamination by ensuring nitrate levels below five mg/l.

Interim Wellhead Protection Areas

“...For public water systems using wells or wellfields that lack a Department approved Zone II, the Department will apply an interim wellhead protection area. This interim wellhead protection area shall be a one-half mile radius measured from the well or wellfield for sources whose approved pumping rate is 100,000 gpd or greater. For wells or wellfields that pump less than 100,000 gpd, the IWPA radius is proportional to the approved pumping rate which may be calculated according to the following equation: IWPA radius in feet = (32 x pumping rate in gallons per minute) + 400. A default IWPA radius or an IWPA radius otherwise computed and

determined by the Department shall be applied to transient non-community (TNC) and non-transient non-community (NTNC) wells when there is no metered rate of withdrawal or no approved pumping rate.”

Identifying and approving Zone II areas can take several years. While that process is underway, an IWPA can be designated in order to prevent or minimize contamination. Strict standards for groundwater discharge and construction of sewer lines, as well as efforts to prevent the siting of harmful facilities, will be enforced to protect against contamination until a Zone II area of wellhead protection can be established.

Within the aquifer, there are 52 Interim Wellhead Protection Areas and 28 Zone II Protection areas. There are no Zone III protection areas in any of the seven towns overlaying the aquifer. The table below shows how many IWPA's and Zone II wellhead protection areas are in each town (not just those within the aquifer). The last row shows the number of wellhead protection areas *in the aquifer*.

Table 5 – Recharge Areas

Town	Zone II	IWPA
Plymouth	22	31
Carver	4	20
Kingston	7	2
Wareham	3	2
Plympton	2	6
Bourne	9	5
Middleborough	8	10
Aquifer	28	52

As mentioned above, wellhead protection areas safeguard recharge lands for *existing* wells. Given the current regional increase in population, however, it is important that towns also identify future well sites so that their recharge areas can be identified and protected. Plymouth and Wareham have already completed studies to identify potential future well sites.

Working with SEA Consultants, Inc., Wareham identified and tested five potential well sites. Initial site determination criteria included the “potential high yield of aquifer materials, existing water quality, existing and potential future land use favorable to protection of water quality, potential to provide operational flexibility of water system, environmental permitting requirements, land ownership issues, and proximity to existing distribution system” (Ryan, 2006). Wareham considered permitting, land ownership, yield, proximity to distribution system, existing water quality, and ground elevation of each site, ultimately choosing to develop the Maple Park Well located just west of the Glen Charlie Pond. Plymouth’s initial site determination considered existing land use factors such as contaminated sites, storage tanks, groundwater discharge permits, and DEP-regulated facilities with potential environmental impacts; water resources such as wetlands, surface water bodies, existing wells, and hydrogeologic data; industrially zoned areas, state-identified non-potential drinking water source areas; and areas with surficial geology unsuitable for developing water supply (Wright-Pierce, 2006).

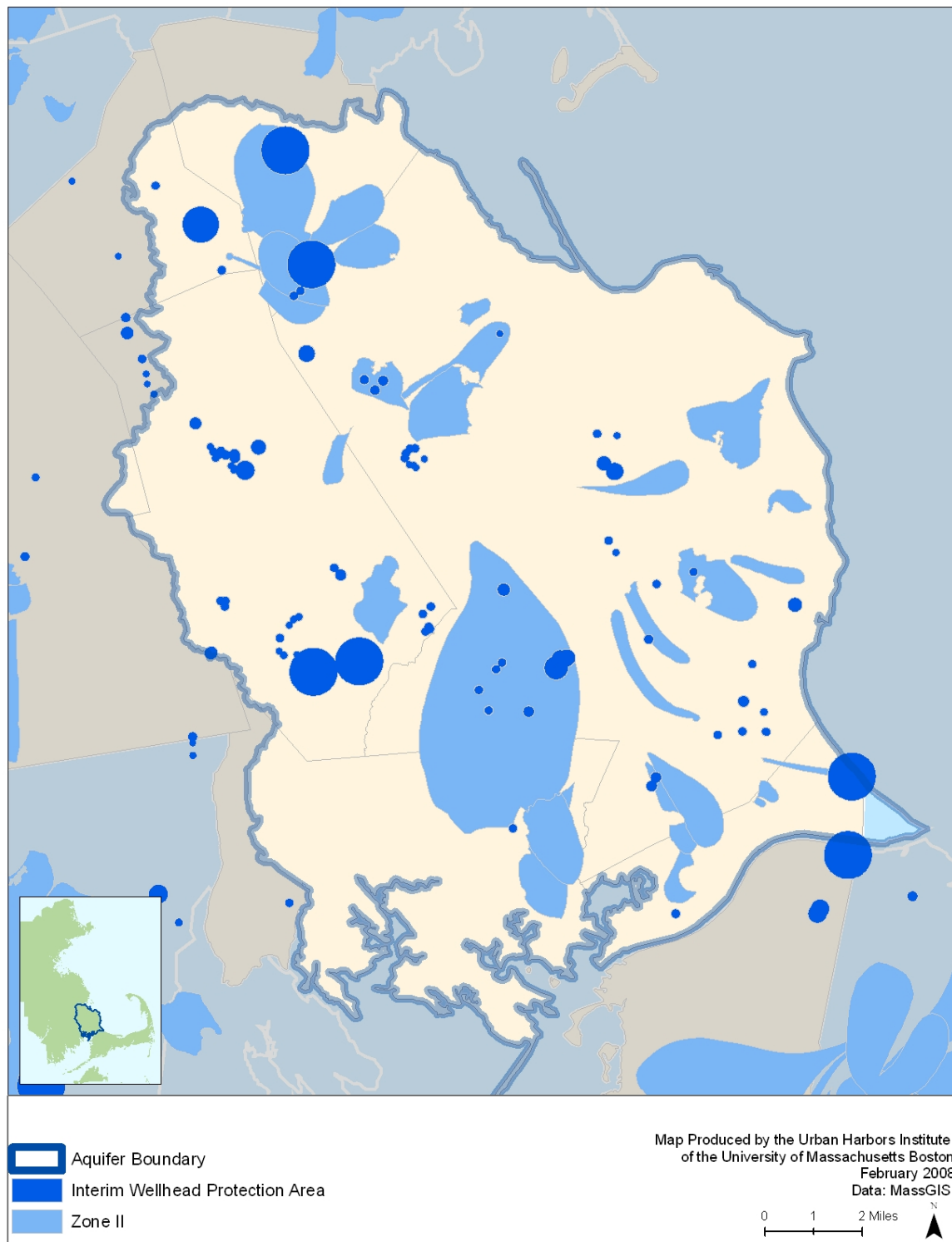


Figure 3--Existing Wellhead Protection Areas

In addition, Plymouth worked with The Nature Conservancy and Wright-Pierce, Inc. to eliminate sites that would threaten high-quality coastal plain ponds, which provide habitat to numerous rare species. According to research from The Nature Conservancy, withdrawing groundwater near a coastal plain pond may impact seasonal water level fluctuations in the pond, preventing the seasonal flooding needed to keep woody vegetation from displacing the existing vegetation adapted to withstand the water level fluctuation (Wright-Pierce, 2006).

GIS analysis and site visits identified twenty-one potential well locations in Plymouth, of which six were identified as “favorable”. This analysis, which included notes on the strengths and weaknesses of each site, will help Plymouth prioritize future well development based on need and suitability of well locations.

By identifying potential future well sites, Plymouth and Wareham have moved one step closer to pinpointing land important to the water quality and quantity at those sites. Further studies will need to be conducted in order to delineate the recharge areas for those wells. Bourne, Kingston, Middleborough, Plympton, and Carver could benefit from conducting similar studies to identify potential well sites and their recharge areas.

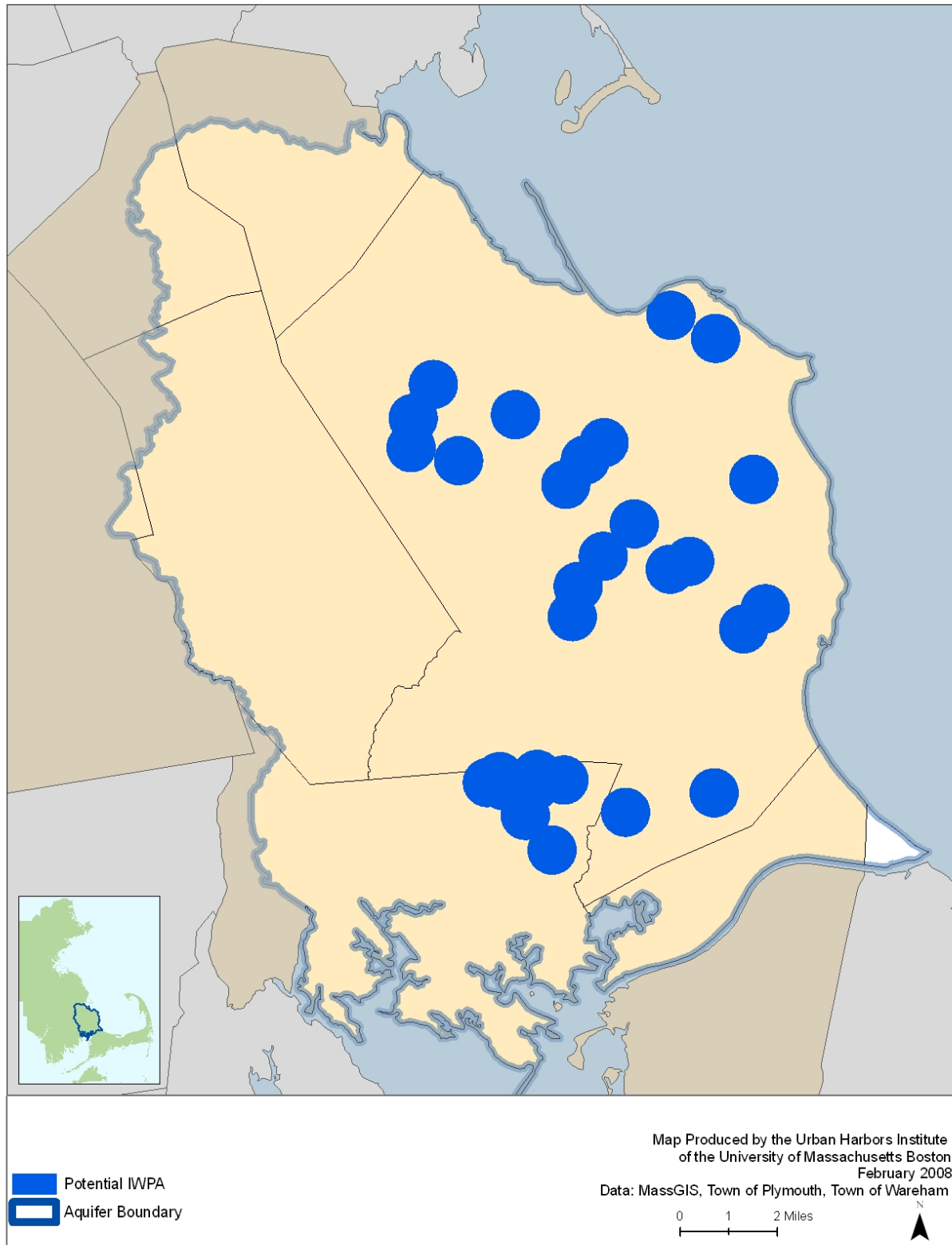


Figure 4--Hypothetical IWPAs for potential wells studied in Plymouth and Wareham

GOAL: To incorporate Aquifer-focused open space planning into town regulations and plans.

Recommendation #1

Towns should develop bylaws to protect aquifer recharge areas by adopting the recommendations put forth by the Bylaws Group led by Horsley Witten. When considering the issue of transferrable development rights and potential receiving areas, towns should specifically look at the location of receiving areas with regard to recharge areas, wellhead protection areas, habitat, and other potential conflicts.

Recommendation #2

The recommendations in this regional open space plan should be integrated into updates of all Open Space & Recreation Plans, Comprehensive Plans, Master Plans, Watershed Plans, and any other relevant plans developed by Aquifer communities.

As mentioned above, the PCAAP clearly states that towns are not interested in adding any new layers of government or regional resource management entities for the sake of protecting the Aquifer. That being the case, each of the seven towns are responsible for implementing the recommendations in this regional open space plan. In order to ensure that towns continue to focus on open space planning related to aquifer protection, it is important that these recommendations be considered as towns update other plans and develop new regulations.

Towns should also consider implementing the Transferrable Development Rights Recommendations developed by the Horsley Witten Group. Maps have been produced to help towns begin to identify potential receiving areas for higher density development (See Appendix C).

GOAL: To ensure continued collaboration among the seven communities for the protection and acquisition of open space.

Recommendation #1

Towns and land protection agencies should continue to work together to protect the health of the aquifer. More specifically, representatives from each town should continue to meet regularly to discuss progress on open space acquisitions and on opportunities to collaborate.

Recommendation #2

When appropriate, towns and land protection agencies should work together to secure funding for open space protection with Aquifer-related benefits.

Water and contaminants move through the aquifer irrespective of municipal boundaries. A decision made in one town may very well have impacts on the quality and/or quantity of water in another town. Communication is essential to ensure that each town is aware of the others' intentions and needs.

Additionally, collaboration among towns and land protection entities may increase the ability to secure funding for purchasing and protecting land. Some potential funding sources include:

- Drinking Water Supply Protection Grants from the Massachusetts Department of Environmental Protection - These grants are open to municipalities and public water systems for land acquisition protecting the quality and quantity of drinking water. They are competitive

reimbursement grants of up to \$500,000 (representing up to 50 percent of a project's cost). More information can be found by contacting Catherine Hamilton at (617) 556-1070 or by email at catherine.sarafinas@state.ma.us

- The Massachusetts Environmental Trust – This trust funds “cooperative efforts to raise environmental awareness; Enable innovative approaches that can restore, protect, and improve water and water-related resources of the Commonwealth.” More information can be found at: www.MassEnvironmentalTrust.org/. Conservation Partnership Grant Program – Open to non public, not-for-profit groups for the purpose of acquiring interests in lands for conservation or recreation. The maximum award for a single project is \$75,000 (50% of the total project cost). Contact Melissa Cryan (Executive Office of Energy and Environmental Affairs): melissa.cryan@state.ma.us for more information. Wildlife Habitat Incentives Program – Provides technical assistance and up to 75% cost-share assistance to efforts which restore native wildlife habitat, tackle habitat issues of at-risk species, reduce the impact of invasive species, and address aquatic wildlife habitats. More information can be found at: <http://www.nrcs.usda.gov/programs/whip/>.
- Wetlands Reserve Program – Assists landowners in restoring, enhancing, and protecting wetlands on their property. Landowners can choose from three different program options: permanent easements, 30-year easements, or restoration cost-share agreements. More information can be found at: <http://www.nrcs.usda.gov/programs/wrp/>.
- Healthy Forest Reserve Program – Encourages the recovery of threatened and endangered species, improves biodiversity, and enhances carbon sequestration on private or tribal land. More information can be found at: <http://www.nrcs.usda.gov/programs/HFRP/ProgInfo/Index.html>.
- Local Acquisition for Natural Diversity: LAND Grants Program – Covers the cost of land acquisition (or the cost of a partial interest such as a conservation restriction) for land that has natural resource and passive outdoor recreation benefits. The LAND Grants program is open to conservation commissions, and public access is a requirement. More information can be found at: <http://www.mass.gov/envir/dcs/selfhelp/default.htm>

CONCLUSION

The Plymouth-Carver Sole Source Aquifer is a crucial resource for the communities in southeastern Massachusetts. As the towns continue to grow, the risk of contamination will increase, as will the demand for water. Fortunately, towns can take planning steps now to acquire or preserve open space that will positively affect the quality and quantity of water in the Aquifer in the future.

This plan provides recommendations, tools, and maps to help guide those planning efforts, including a matrix to help prioritize land acquisitions, maps to initiate planning for Transferrable Development Rights, and information about siting future wells. While this plan takes into consideration the importance of home rule expressed in the PCAAP, it is imperative that the towns and stakeholders continue to work together to protect their shared resource.

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APPENDIX A: Ranking Matrix and Maps

The purpose of this appendix is to help guide open space acquisition and protection that benefits the Aquifer; however, there are many other factors that could potentially influence an open space decision such as land's recreational, historic, and scenic value. Groups looking to prioritize parcels for acquisition can compare the value of land under consideration by using the matrix in this appendix.

Many of the priorities found in the matrix were identified during meetings and/or in town plans. This list is by no means exhaustive, and user groups are invited to add additional priorities and functions/attributes as needed.

A description of and instructions on how to use the matrix and maps follow.

INSTRUCTIONS

This matrix is intended for use by a group of people in a position to acquire or protect land as open space. Members of a user group should **work together** to fill in one matrix for each area of land under consideration.

BEFORE YOU CONSIDER A SPECIFIC AREA/PARCEL:

Step 1:

The first thing all groups should do is finish filling in the *weight* column for each *function/attribute*. The *weight* is the ability of a particular *function/attribute* to achieve a priority. For example, in aquifer protection, the fact that an area crosses municipal boundaries has less impact on aquifer protection than does the % of impervious surface; therefore, *low % impervious surface* has a higher weight than *crosses municipal boundaries*. It should be stressed that these are weights and not ranks, so if multiple *functions/attributes* share the same level of importance, they should have the same weight.

The *weights* have been assigned for aquifer protection and habitat functions/attributes based on literature reviews and the input of experts in relevant fields. Each user group should fill in the remaining *weights* for *recreation*, *historic preservation*, *quality of life*, *scenic value*, and *agricultural sustainability*. The *weights* should be filled in on a scale of one (1) to five (5), with one being low, and five being high.

It is important that groups fill in the *weights* based on their specific goals, and NOT based on a particular property. For example, if a town was completing the *weights* and was looking for ways to showcase the town's character, then *Town's Character* would receive a high *weight* (a 4 or 5) because it helps satisfy the town's goals related to *scenic value*. Similarly, if a town was not interested in acquiring land for new agriculture, *New agricultural activity* would have a very low *weight* (a 1 or 2) because it does not help the town achieve any of its goals related to *agricultural sustainability*.

Step 2:

Once all *weights* have been assigned, matrix users can fill out the *maximum points* column. To do this, the matrix user will multiply the weight of each function/attribute by five (5) – which is the maximum possible *value* any function could receive. The *maximum points* should be added together to get a total for each priority.

Step 3:

Once all maximum values have been assigned to the *priorities*, users can determine the multiplier for each priority. Because each priority has a different number of attributes, a multiplier must be used to equalize the priorities so that they are all based on the same number of possible points.

First, identify the *priority* with the highest *maximum point* total. The *multiplier* for that priority will be one (1). To determine the *multipliers* for the other *priorities*, divide the highest *maximum point* total by the *total maximum points* for each of the other priorities.

Step 4:

In addition to filling in the weights for each function/attribute, matrix users should also fill in the *user priority weight* column. Unlike the *weight* described above (which speaks to a function or attribute's ability to accomplish a priority), the *user priority weight* clarifies how important a priority is in making an open space related decision. For example, if a land trust was using the matrix and their main priority was to acquire land that provided habitat, the land trust would give *habitat* a high *user priority weight*. If that same land trust had no interest in acquiring land for *agricultural sustainability*, they would assign that priority a low *user priority weight*.

As with assigning *weights* to the *functions/attributes*, the *user priority weight* should be determined based on the overall goal of the matrix users, and NOT based on a particular property.

Both the *weight* and the *user priority weight* should remain the same for all parcels unless the overall goal of a matrix user group changes significantly. For example, if a town experiences a quick and dramatic loss of cranberry bogs in the area, they may wish to re-evaluate the *weight* and *user priority weight* to reflect a need to protect the remaining cranberry bogs in town.

WHEN CONSIDERING A SPECIFIC PARCEL/AREA:

Step 1:

Matrix users must assign a *value* to each function/attribute. The *value* of a *function/attribute* is the ability of the land in question to achieve the *priority*. The *value* is assigned on a scale of one (1) to five (5) with one being of little value and five being of high value. For example, if a particular parcel was wooded and had no real agricultural value, the matrix user would give it low scores on *new agricultural activity*, *existing agricultural activity*, and *agricultural activity enhanced*. The *values* may be straightforward, or complex. Maps have been developed to help address some of these issues, but data quality varies; **therefore site visits and additional informational resources should be used to verify data on maps.**

The following descriptions are provided to help users assign meaningful *values*:

AQUIFER PROTECTION (These should only be filled out if the parcel is thought to have recharge value. Use the accompanying maps to help decide if a parcel has recharge value).

- Maintains or creates low % impervious surface— This would include areas that have existing low % impervious surface as well as areas where a high % impervious surface could be drastically reduced
- Lowers or maintains low level of contamination --Refer to contamination and zoning maps -- This would include ending contamination from a current land use. This would also include preventing contamination by a potential future use by taking it out of development. When considering contamination, also be aware of historical land uses.

- Is located near existing or potential wellhead or in a particularly important recharge area – Refer to wellhead recharge area maps to get a sense of location of larger wellheads -- This would take into consideration how large the parcel is - specifically looking at how its size impacts the aquifer (great deal of recharge, prevents a lot of contamination, etc.). This would also take into consideration the location of the parcel, including whether or not it connects two important recharge areas, is located in a Zone I, would provide protection to a specific existing or potential well, etc.
- Serves large number of people – This includes the number of people whose water quality and/or quantity would be enhanced by acquiring the land. While an exact number might be hard to determine, this is about the scale of the benefits; therefore, if a parcel will impact only a few people, its value would be lower than a parcel that would potentially impact a lot of people. It is important to consider people in other towns who might receive benefits
- Crosses municipal boundaries – Refer to Wellhead Protection Area, and Potential Recharge Area maps -- This would include areas of land that extend into multiple towns, as well as parcels that provide aquifer benefits to multiple towns. For example, if a map indicates that a parcel is located in a recharge area in Carver, but the well is in Plymouth, this would receive a high value

HABITAT

- Protects/provides/restores habitat of rare, threatened, or endangered species – Refer to habitat map -- If an area does not provide habitat to rare, threatened, or endangered species, it should receive a low score. Also consider the location of the land with regard to habitat for rare, threatened or endangered species
- Protects/enhances unique habitat such as vernal pools – Refer to habitat map -- Also consider the location of the land with regard to proximity to vernal pool(s)
- Secures large and/or well located parcel with habitat value – Refer to habitat map. Larger parcels or parcels connecting habitats would provide more habitat value than smaller fragmented sites. This could be verified through a field visit or other resources
- Protects/restores habitat supportive of diverse species – Though a parcel may not provide habitat for rare, threatened or endangered species, it may provide habitat for other species. Consider diversity of species and number of organisms supported

RECREATION

- Provides new recreational opportunity – This would include providing a new swimming area at lake, offering hiking in a new area, or offering skateboarding at a new skatepark, etc. Greatest value might be reserved for new types of activities, as opposed to providing more venues for an existing recreational opportunity
- Improves existing recreational opportunity – This would include expanding the number of ball fields at a park, adding additional picnic space to a campground, etc.
- Links recreational opportunities – This would include connecting existing bike paths, linking hiking trails, etc.. Greatest value might be reserved for those links across municipal boundaries

HISTORIC PRESERVATION

- Preserves historic resource - This would include preserving an historic building, stone walls, old cemeteries, historically significant landscapes, etc. The value might be determined based on how unique an historic resource is
- Enhances historic resource – This would include increasing visitor parking at an historically significant building or allowing for the development of interpretive signs related to an historic event/place, etc. This does NOT include views of historic resources, as those will be captured under *scenic value*

QUALITY OF LIFE

- Maintains/improves health of residents - This would include removing/remediating a harmful land use and other similar accomplishments. This would NOT include recreational benefits, such as walking trails, as those will be captured under *Recreation*
- Maintains/improves/creates educational resource – This would include adding educational interpretive signs or providing an outdoor “lab” for students
- Maintains/improves/creates social resource – This would include acquiring land for a community bandstand or a picnic area
- Maintains/improves fiscal stability – This would include any sort of acquisition that maintained or improved the financial situation of the town/region and its residents. This does NOT include agriculture as that will be captured under *agricultural sustainability*

SCENIC VALUE

- Protects/creates unique view – This would include preserving, enhancing, or creating a view of a picturesque pond or field, a river or the ocean, a wetland, etc. The uniqueness of the view should be considered when applying a value
- Protects/creates historic view – This would include preserving, enhancing, or creating a view of a landmark such as an historic structure, or an historic landscape
- Maintains/improves safety – This would include preserving, enhancing, or creating visual or emergency access to a recreational area or improving driving visibility
- Maintains/improves town's character – This would include preserving, enhancing, or creating views of cranberry bogs, horse farms, fields, etc.

AGRICULTURAL SUSTAINABILITY

- Creates new agricultural activity – This would include providing land for new hay fields, cranberry bogs, Christmas tree farms, grazing land, etc. Higher scores might be given to agricultural activities that employ best management practices or have conservation farm plans
- Supports or enhances existing agricultural activity – This would include expanding the size of an existing agricultural use or ensuring that an agricultural use remain functional. Higher scores might be given to agricultural activities that employ best management practices or have conservation farm plans

Step 2:

Using the *values* assigned, matrix users can fill in the *base score* column by multiplying the *weight* by the *value*. Users should be sure to total up all *base scores* in each priority. This number will tell you how well a parcel performs with regard to each priority. This column will

also allow users to see that out of a possible 50 points for aquifer protection (for example), a parcel received 23 points (for example).

Step 3:

Matrix users should calculate the *adjusted score* by multiplying the total *base score* for each priority by the *multiplier*. This *adjusted score* column would allow users to compare all priorities equally without having to worry about the *maximum points* each priority could have. For example, if a parcel received 23 out of 50 possible points in aquifer protection, and received 12 out of 35 possible points for agricultural sustainability, the multiplier would adjust the score so that you could see how the two priorities compared if they had been out of the same number of possible points.

Step 4:

Having completed all of the other columns, the matrix user can now determine the *total score* of the parcel for each *priority*. To do this, multiply the *adjusted score* by the *user priority weight*. These numbers will reflect the parcel's ability to accomplish a priority as well as the parcel's ability to achieve the users' overall goals.

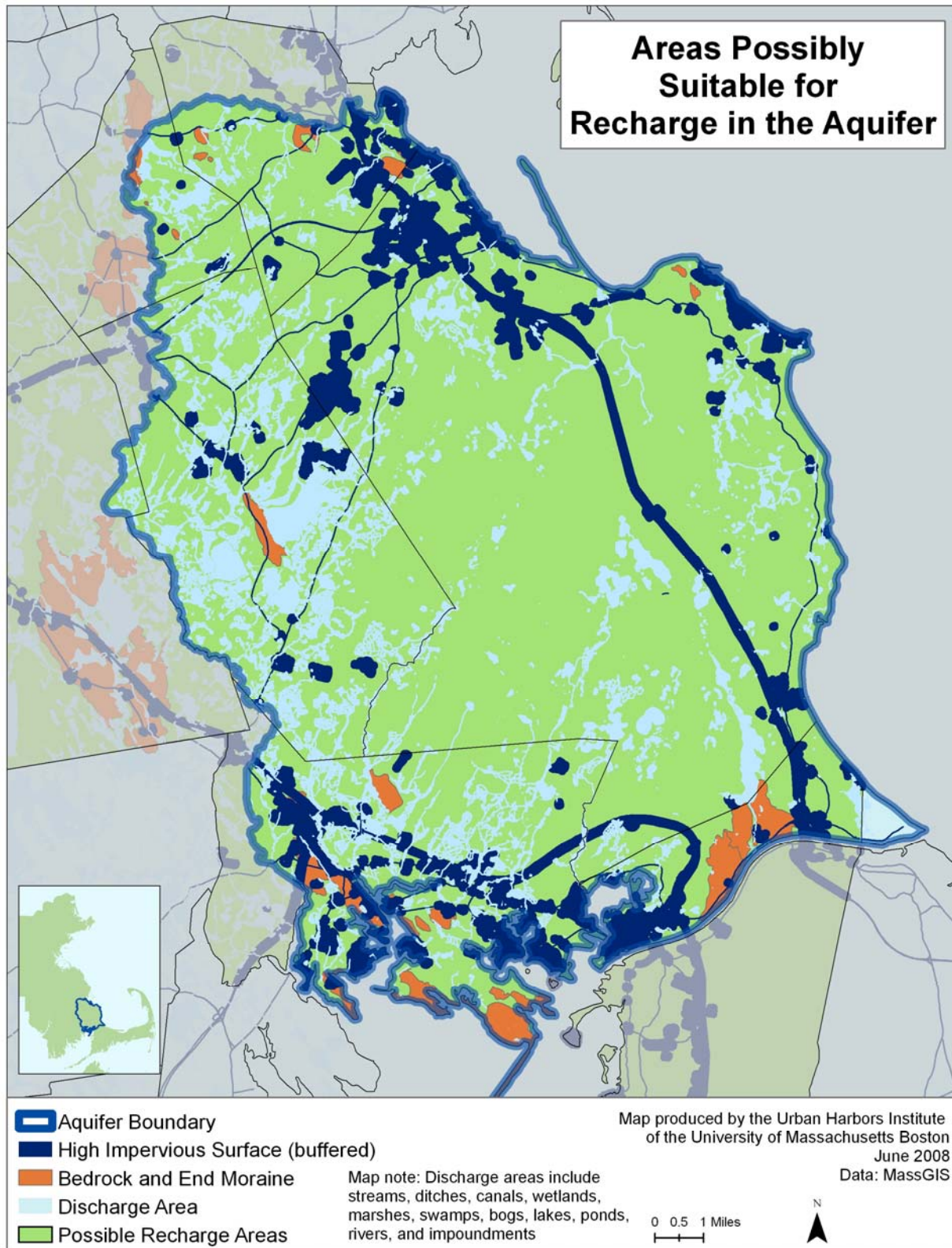
Step 5:

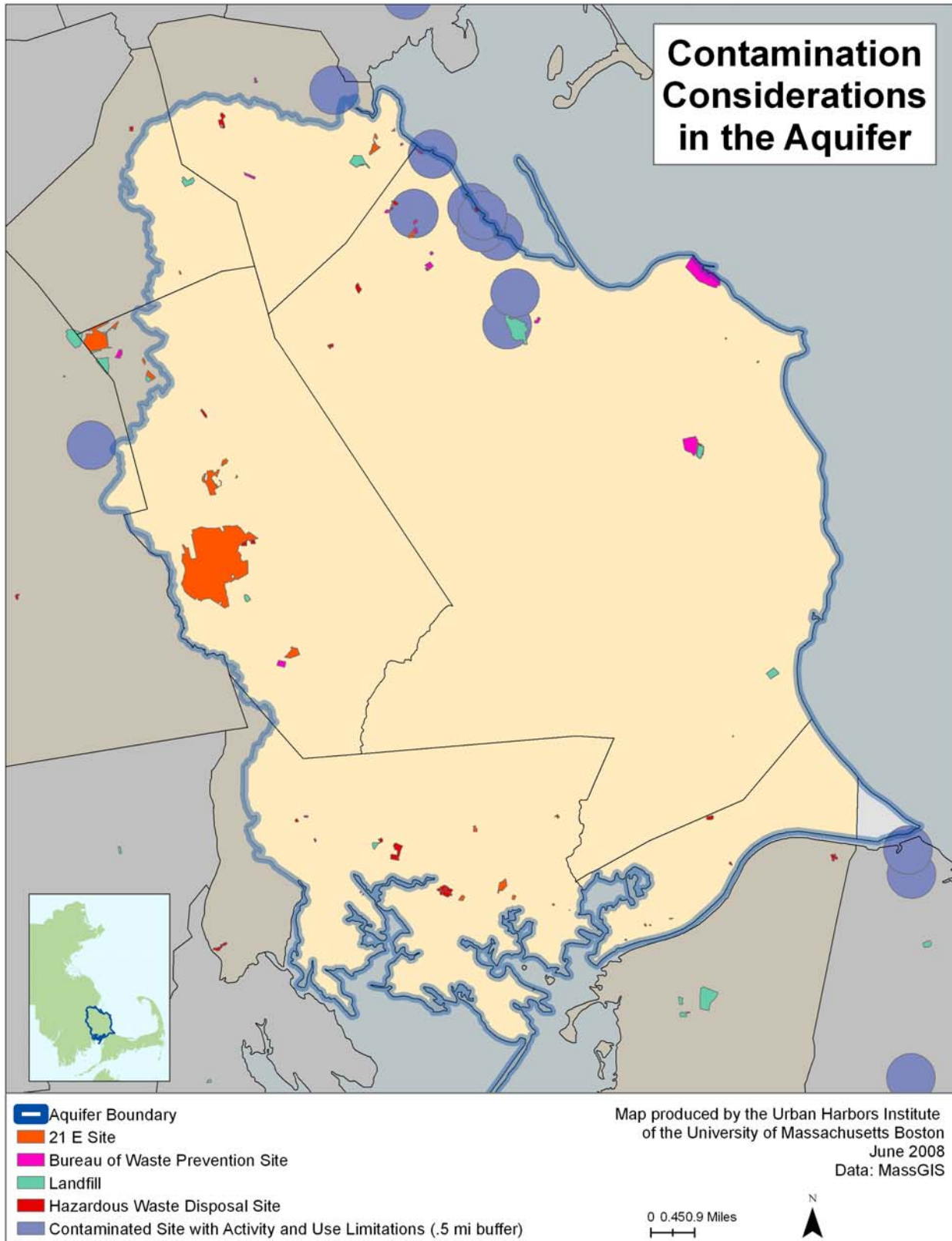
The matrix users should add up all of the numbers in the *total score* column to get the parcel's *final score*. Matrix users can compare *final scores* of different parcels to help determine which might be of highest priority to acquire.

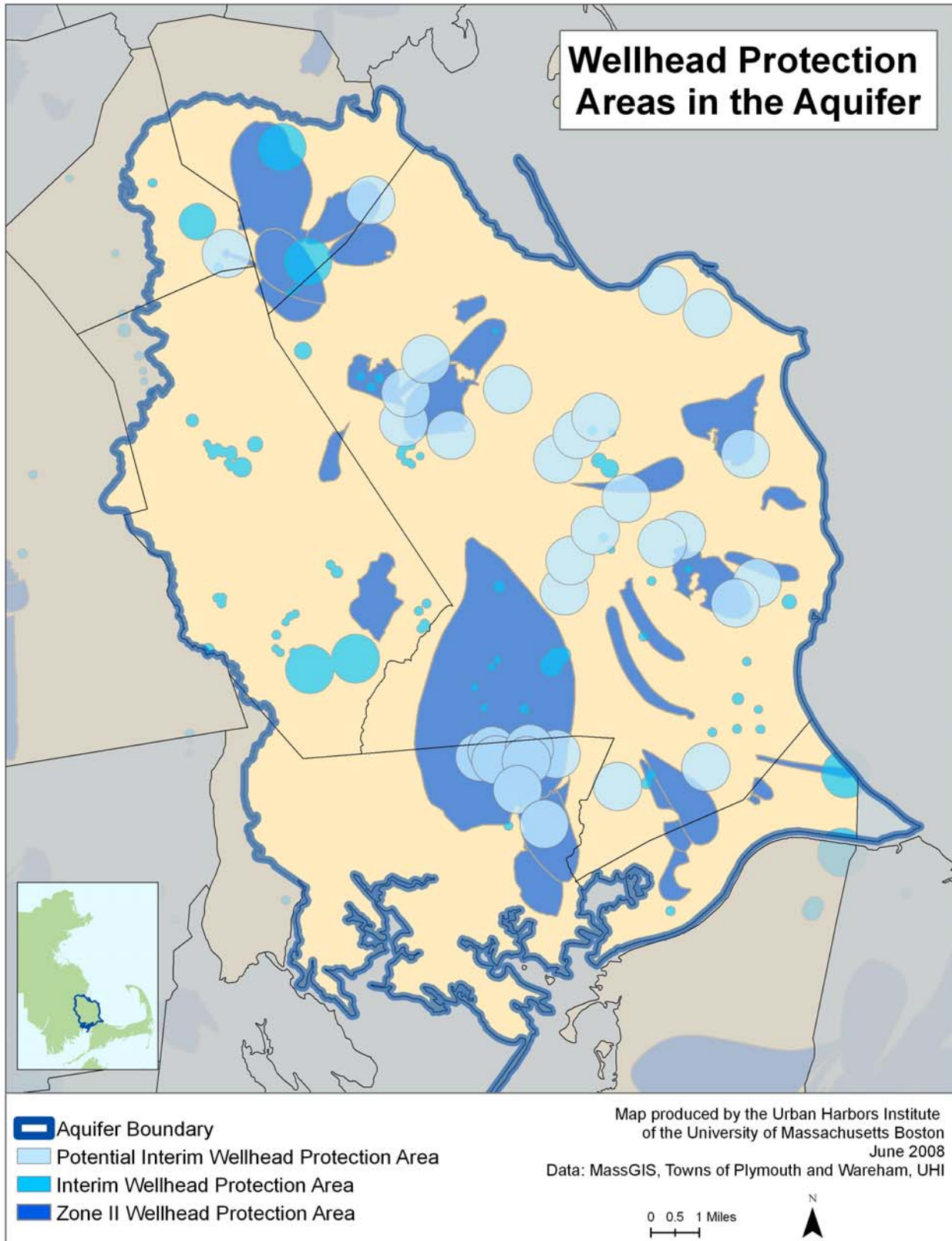
MATRIX MAPS

The following maps have been developed for each town where data was available:

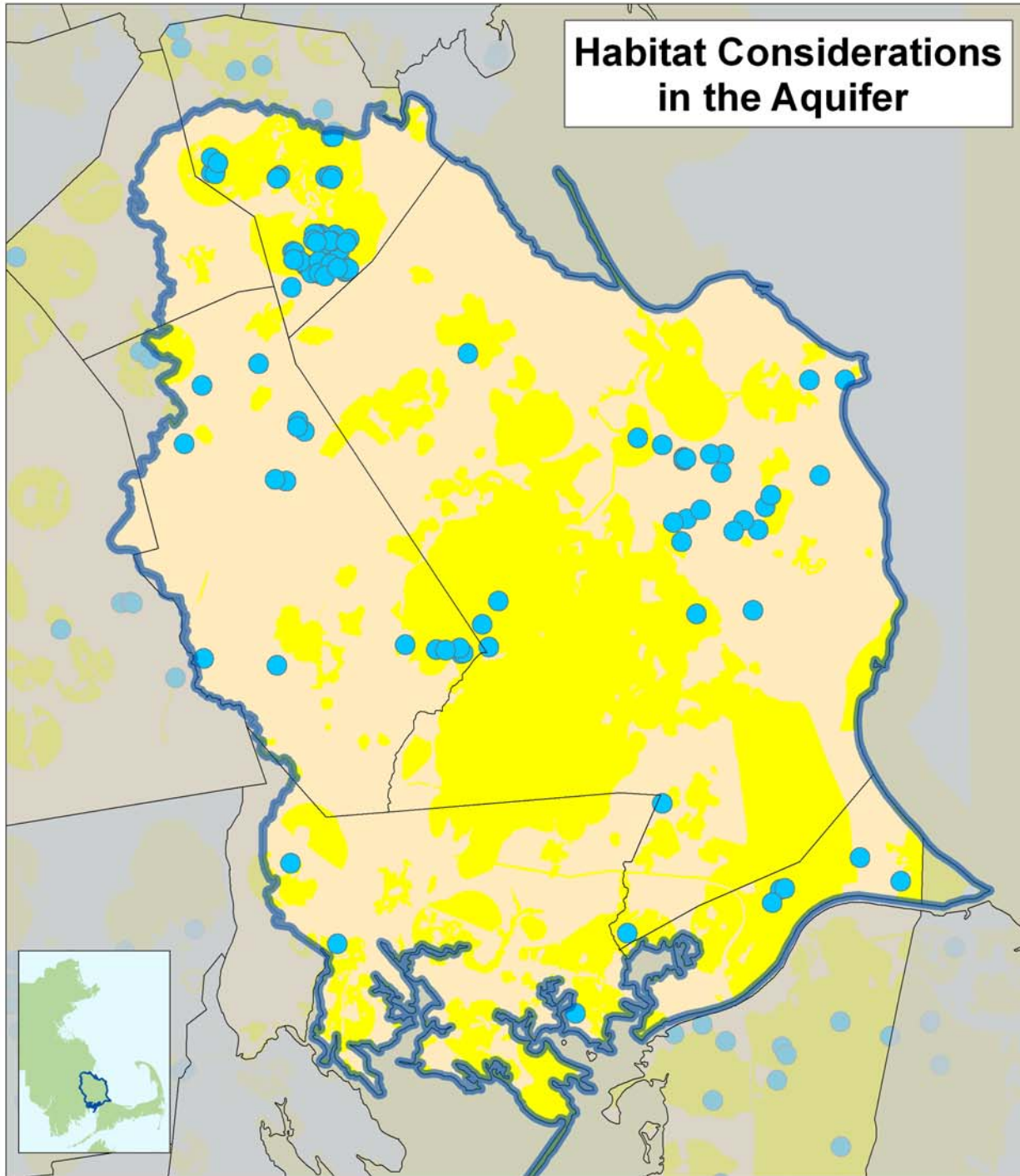
- Areas suitable for recharge
- Contaminated areas
- Protected open space & CH 61, 61A, and 61B land
- Existing wellhead protection areas, including potential wells and their hypothetical recharge areas (for Plymouth and Wareham only)
- Habitat, including certified vernal pools
- Zoning










Habitat Considerations in the Aquifer

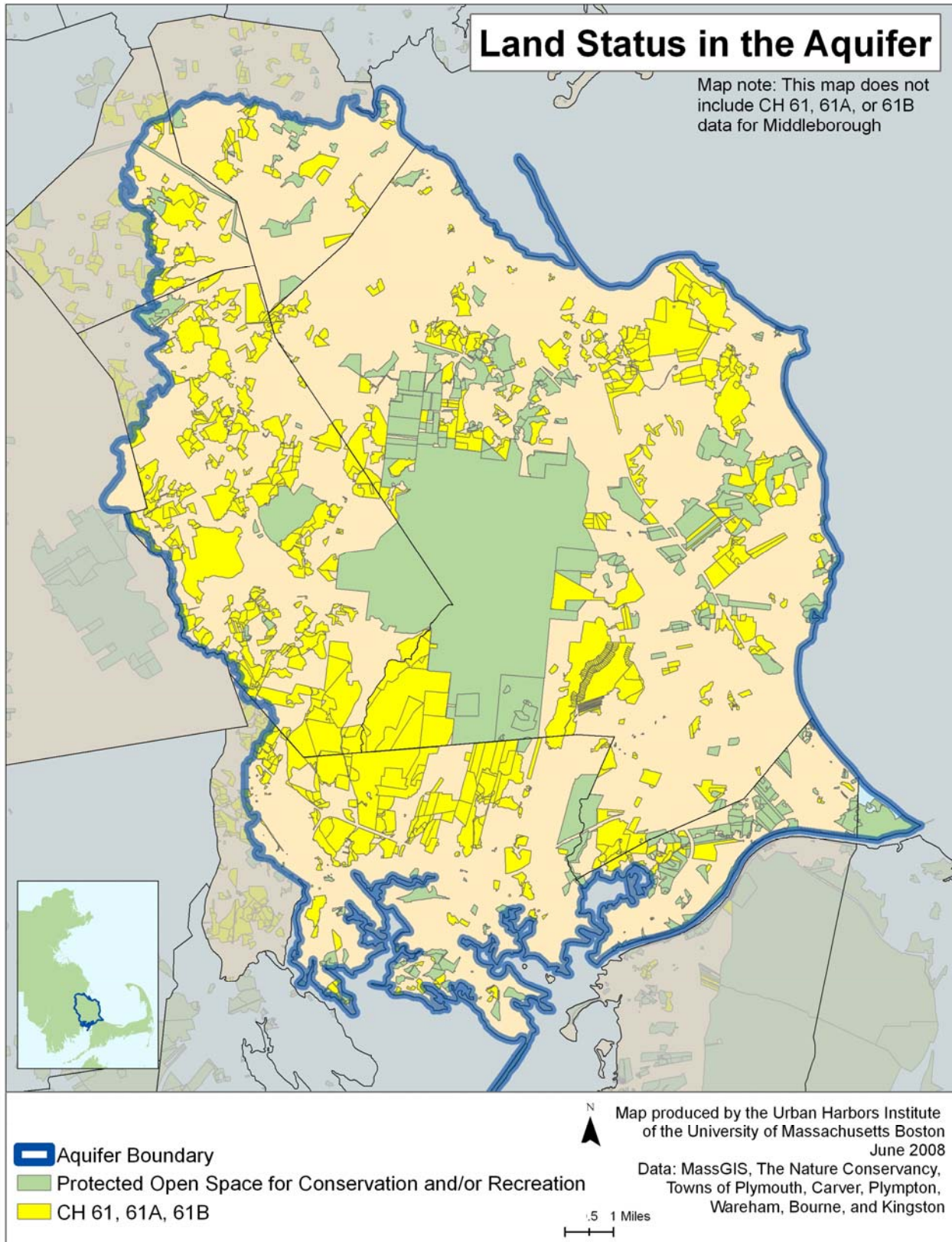


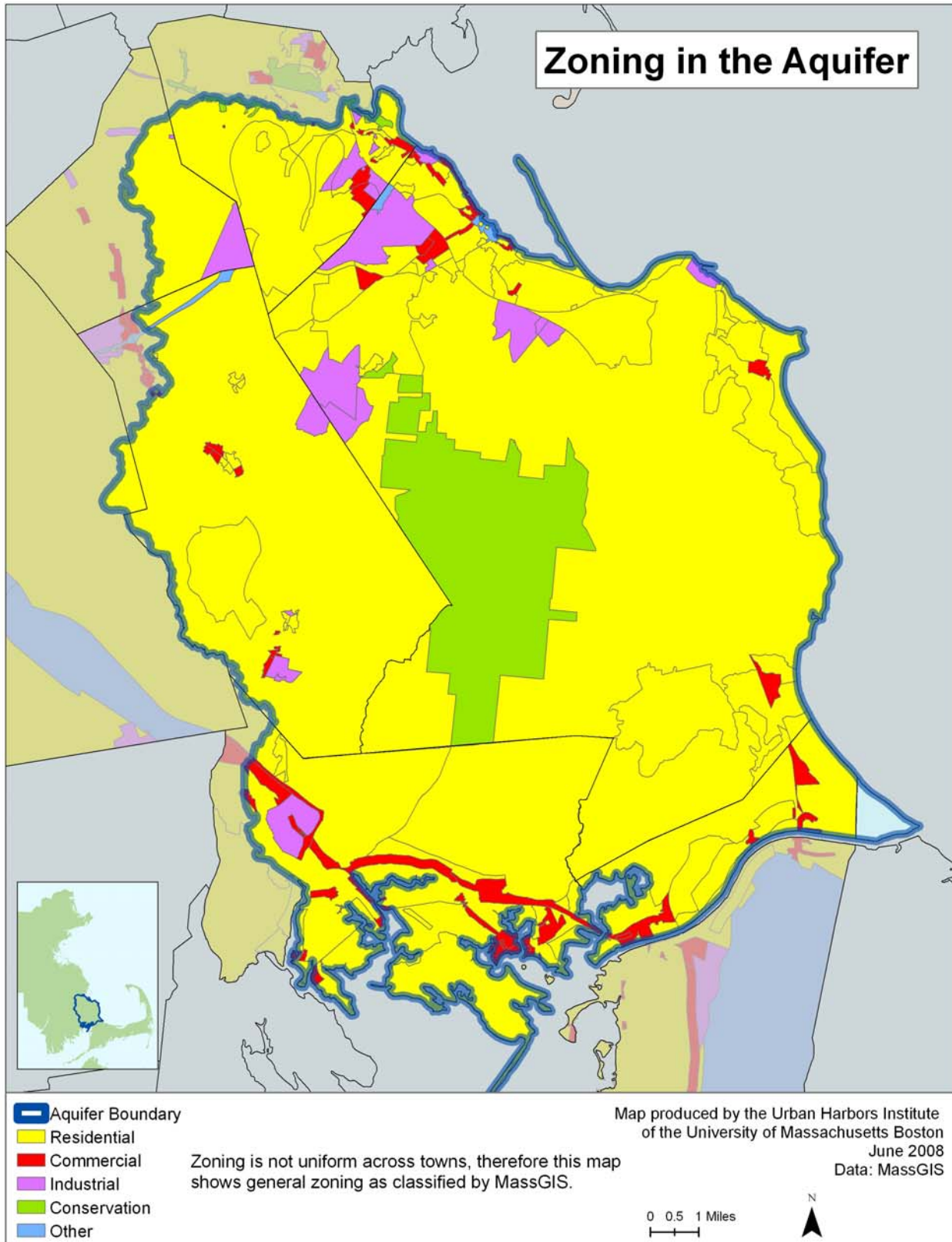
-  Aquifer Boundary
-  Certified Vernal Pools (1000 ft. buffer)
-  Area of Critical Environmental Concern and/or Priority Habitats of Rare Species

Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS

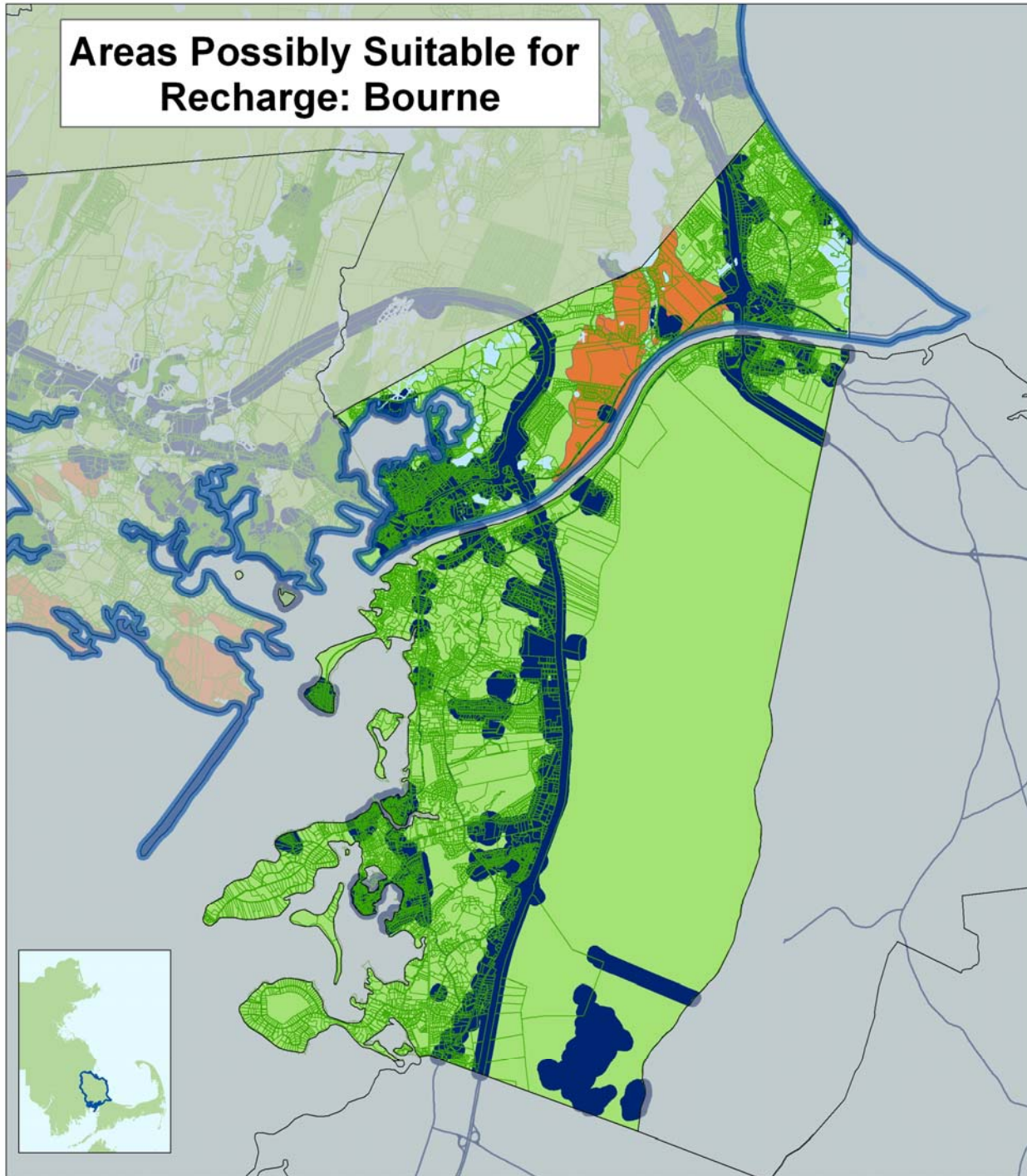
0 0.5 1 Miles







Areas Possibly Suitable for Recharge: Bourne



- Aquifer Boundary
- High Impervious Surface (buffered)
- Bedrock and End Moraine
- Discharge Area
- Possible Recharge Areas

Map note: Discharge areas include streams, ditches, canals, wetlands, marshes, swamps, bogs, lakes, ponds, rivers, and impoundments

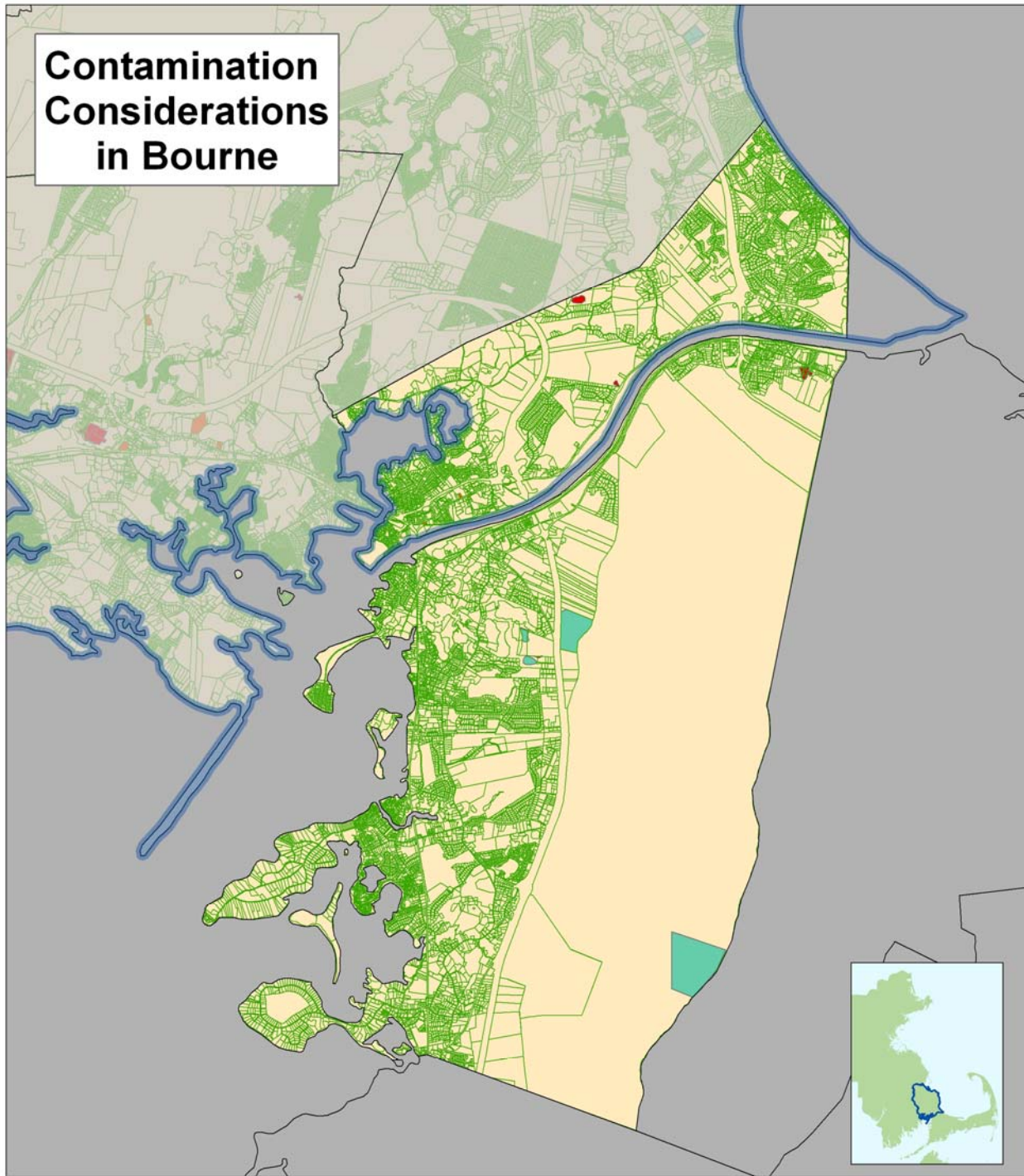
Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008

Data: MassGIS, Town of Bourne

0 0.3 0.6 Miles



Contamination Considerations in Bourne

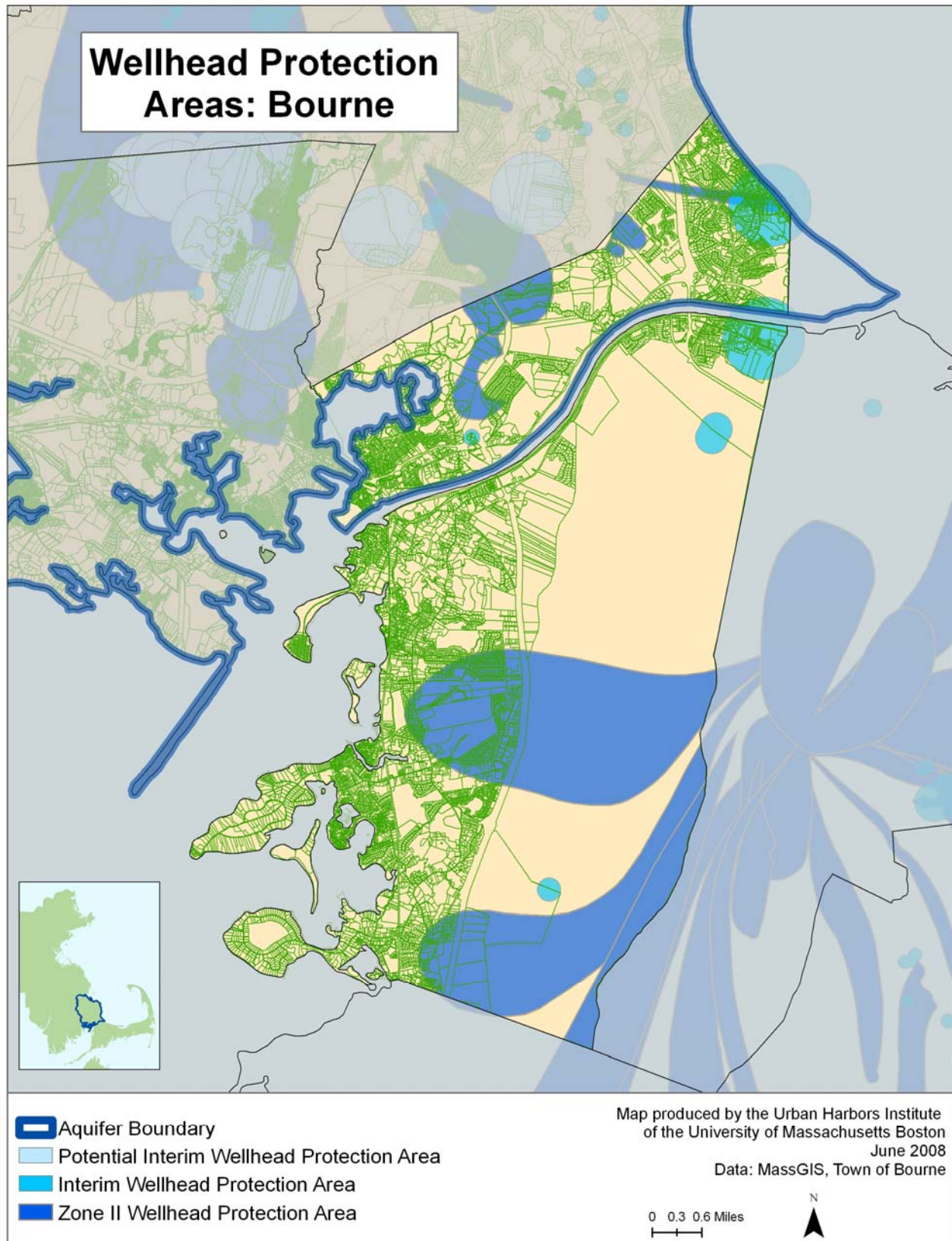


- Aquifer Boundary
- 21 E Site
- Bureau of Waste Prevention Site
- Landfill
- Hazardous Waste Disposal Site
- Contaminated Site with Activity and Use Limitations (.5 mi buffer)

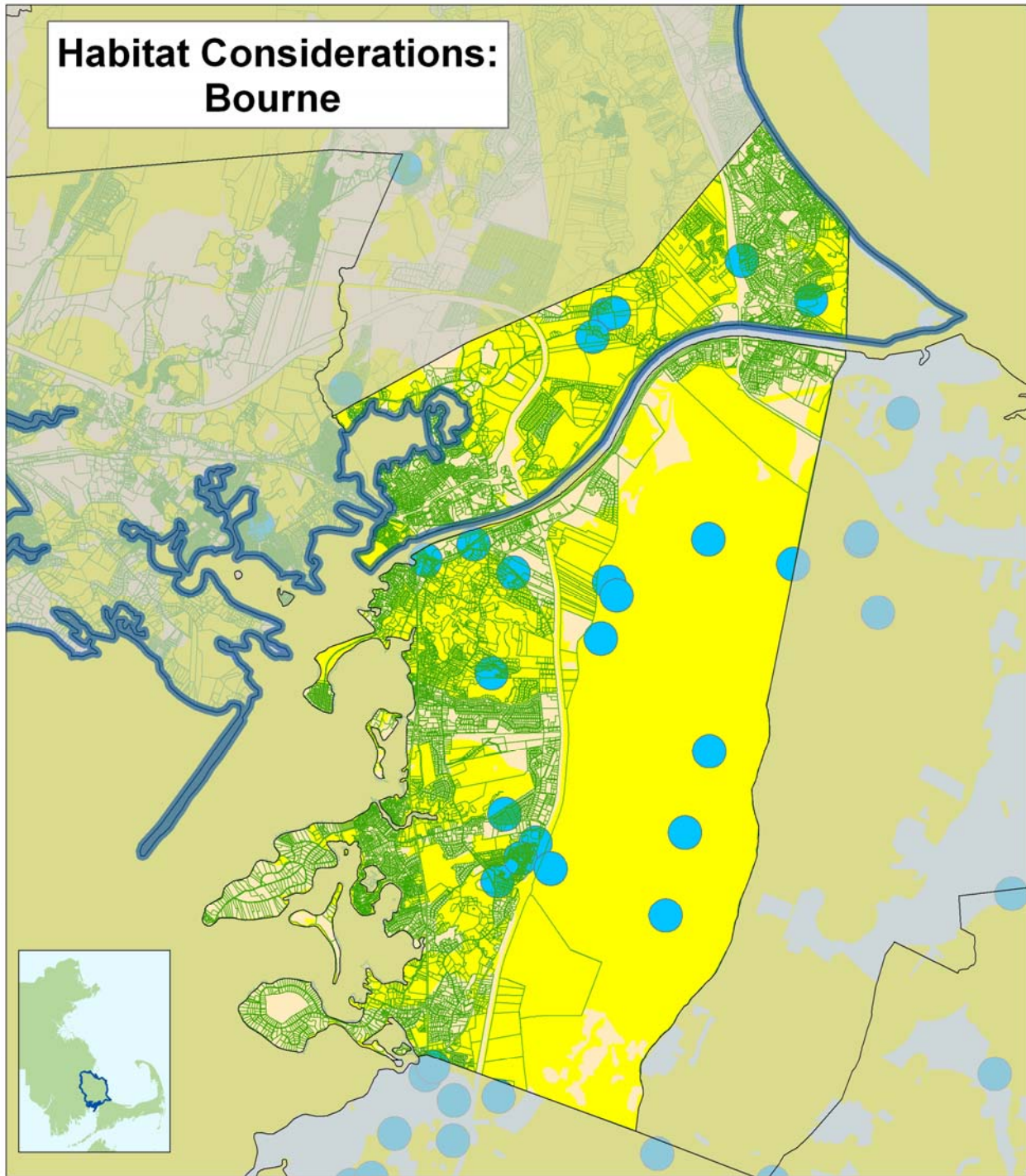
Map Produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS




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Habitat Considerations: Bourne

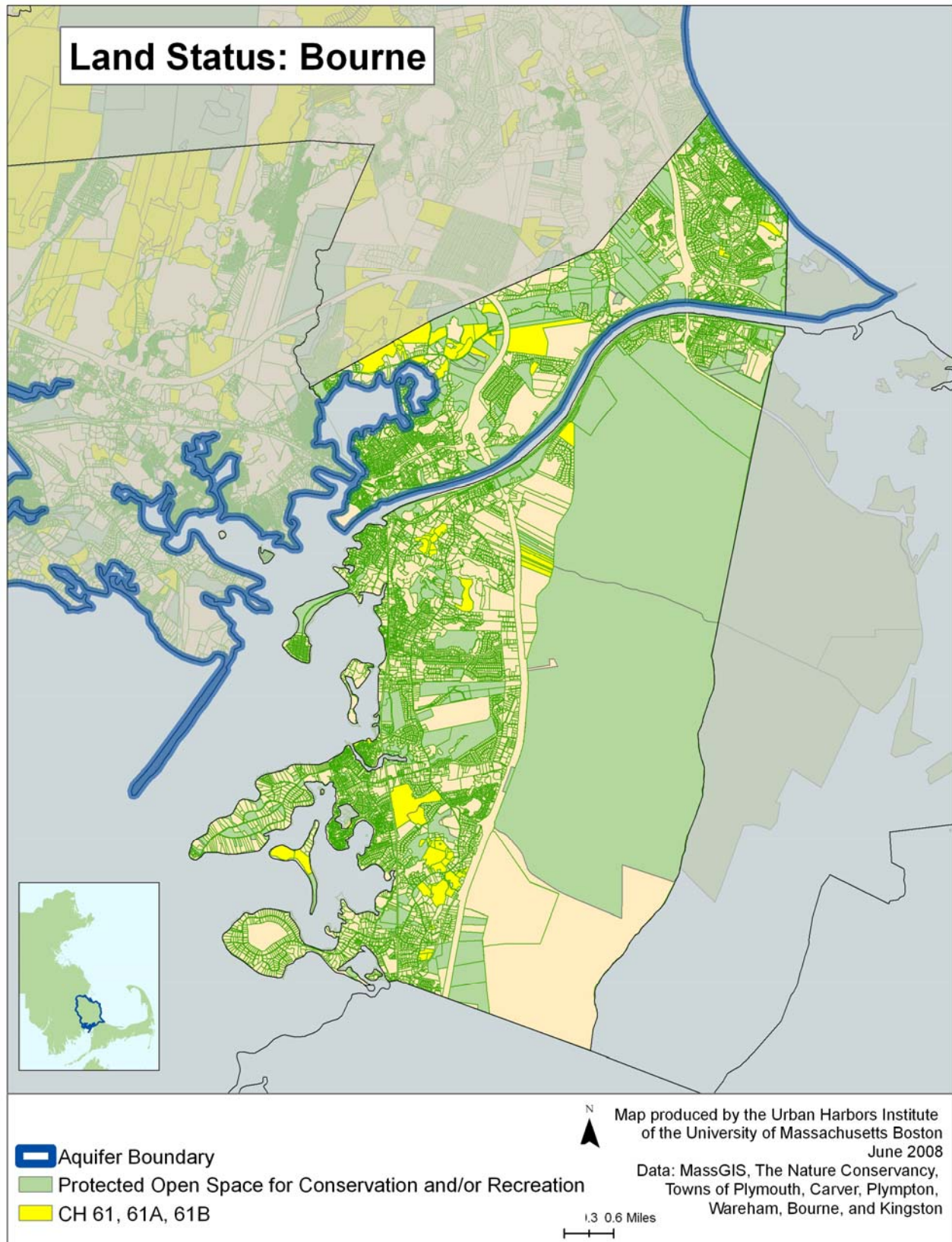


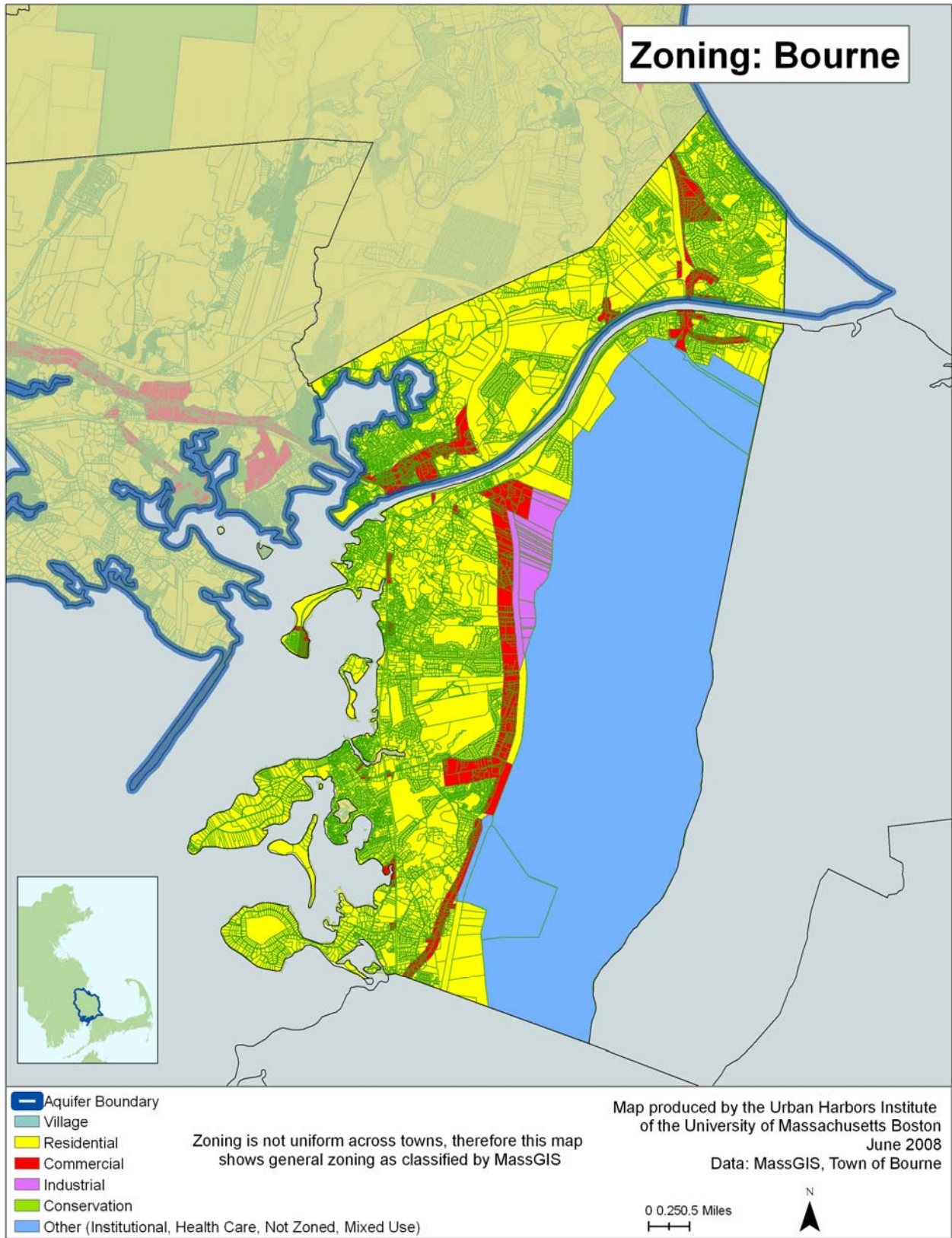
-  Aquifer Boundary
-  Certified Vernal Pools (1000 ft. buffer)
-  Area of Critical Environmental Concern and/or Priority Habitats of Rare Species

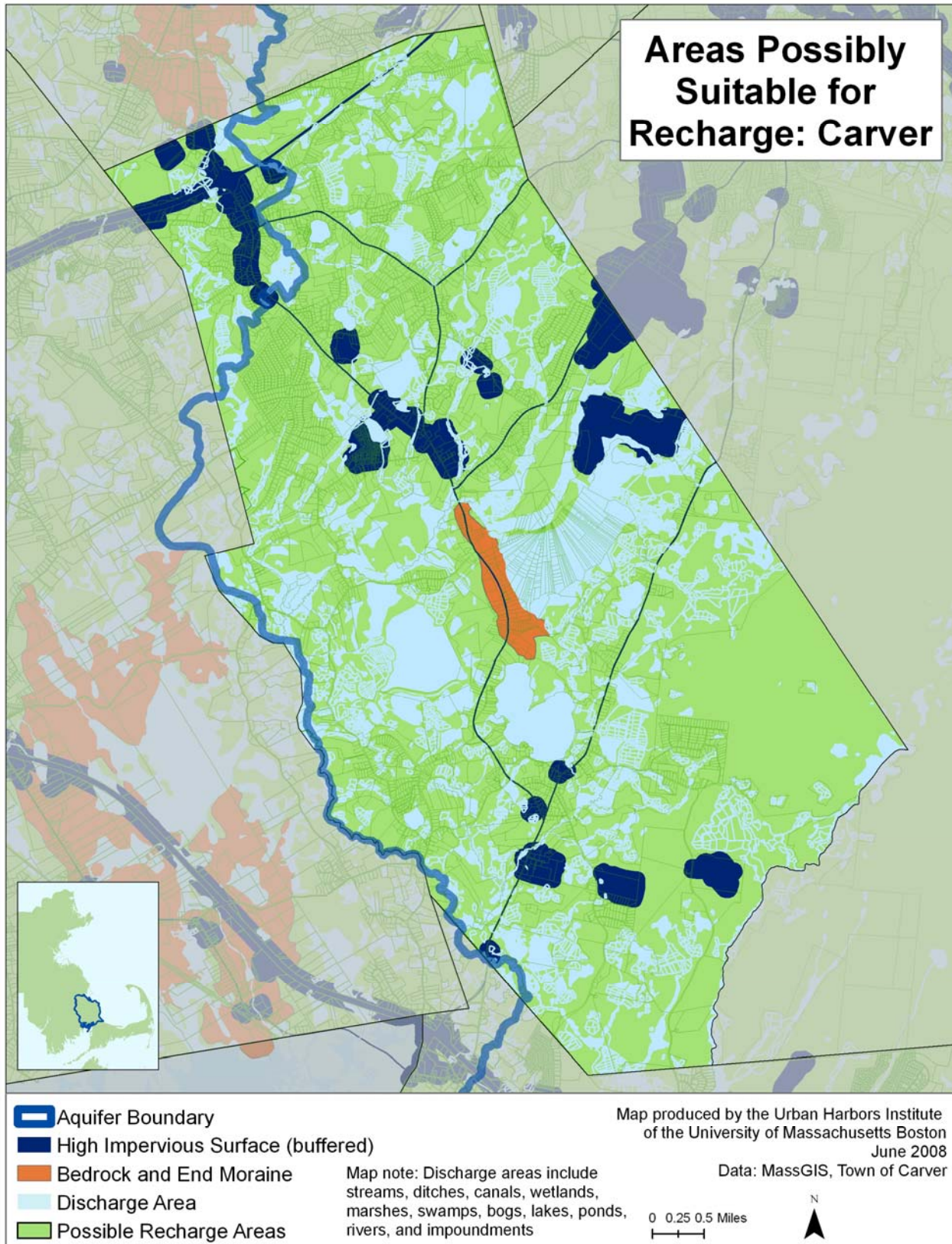
Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS

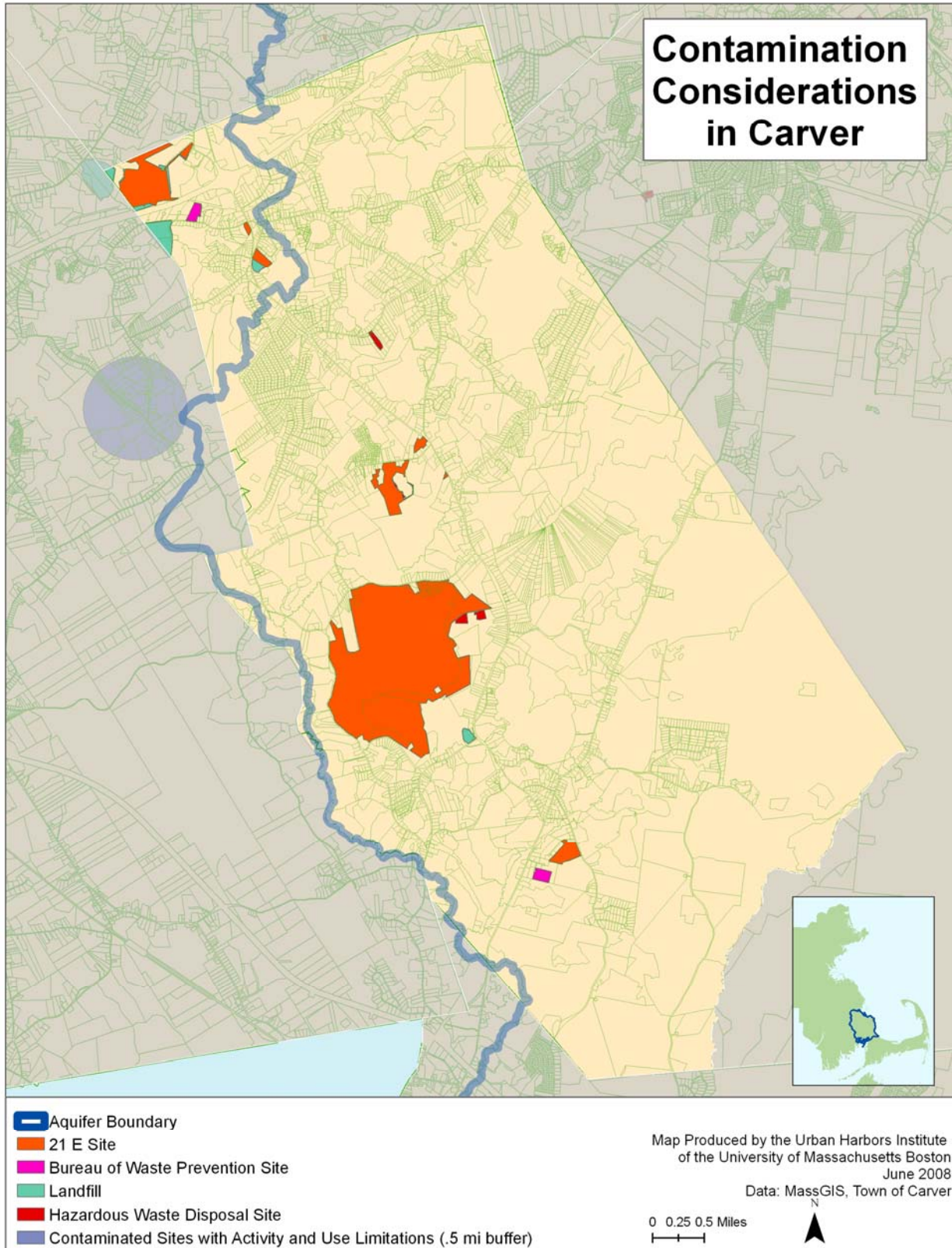
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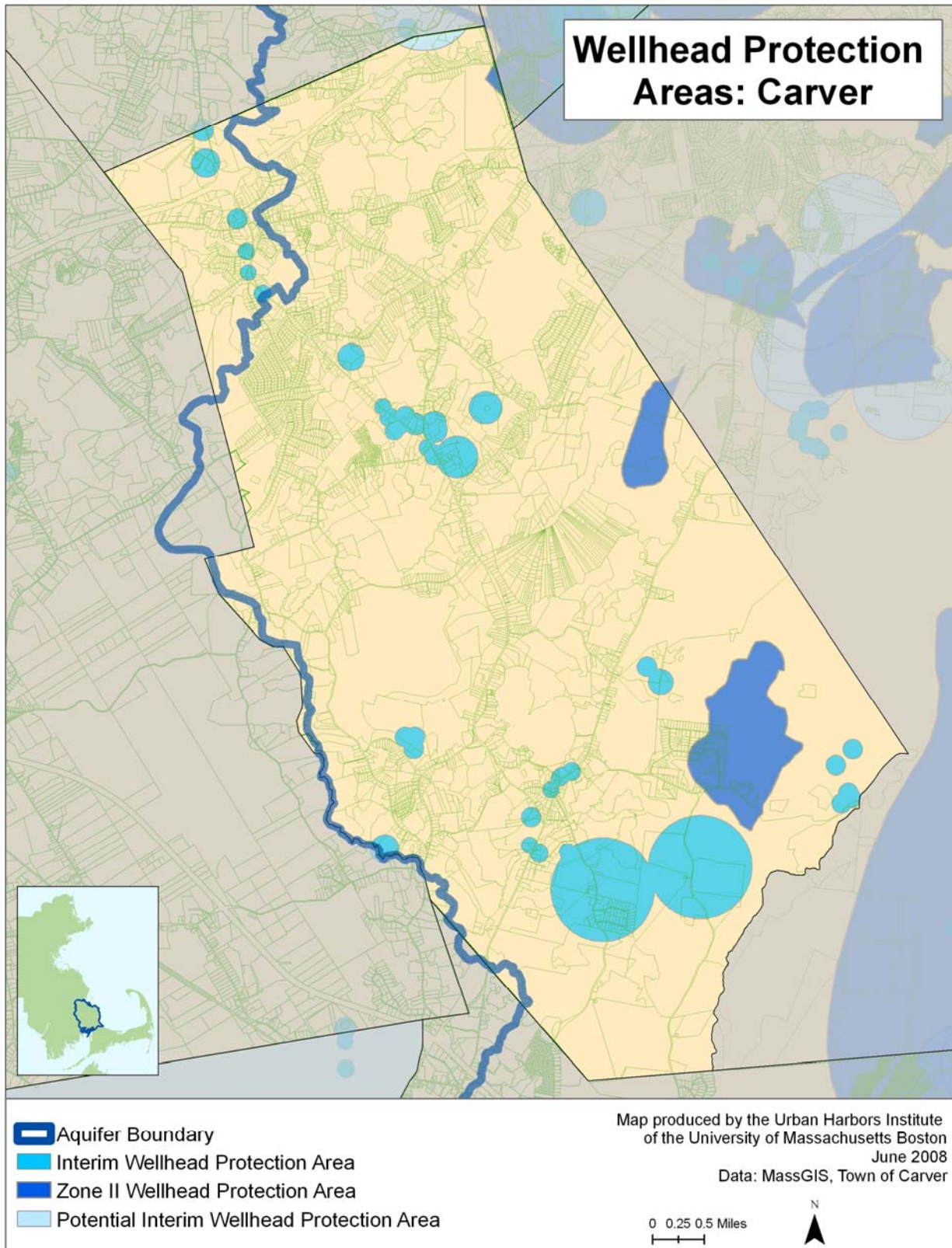


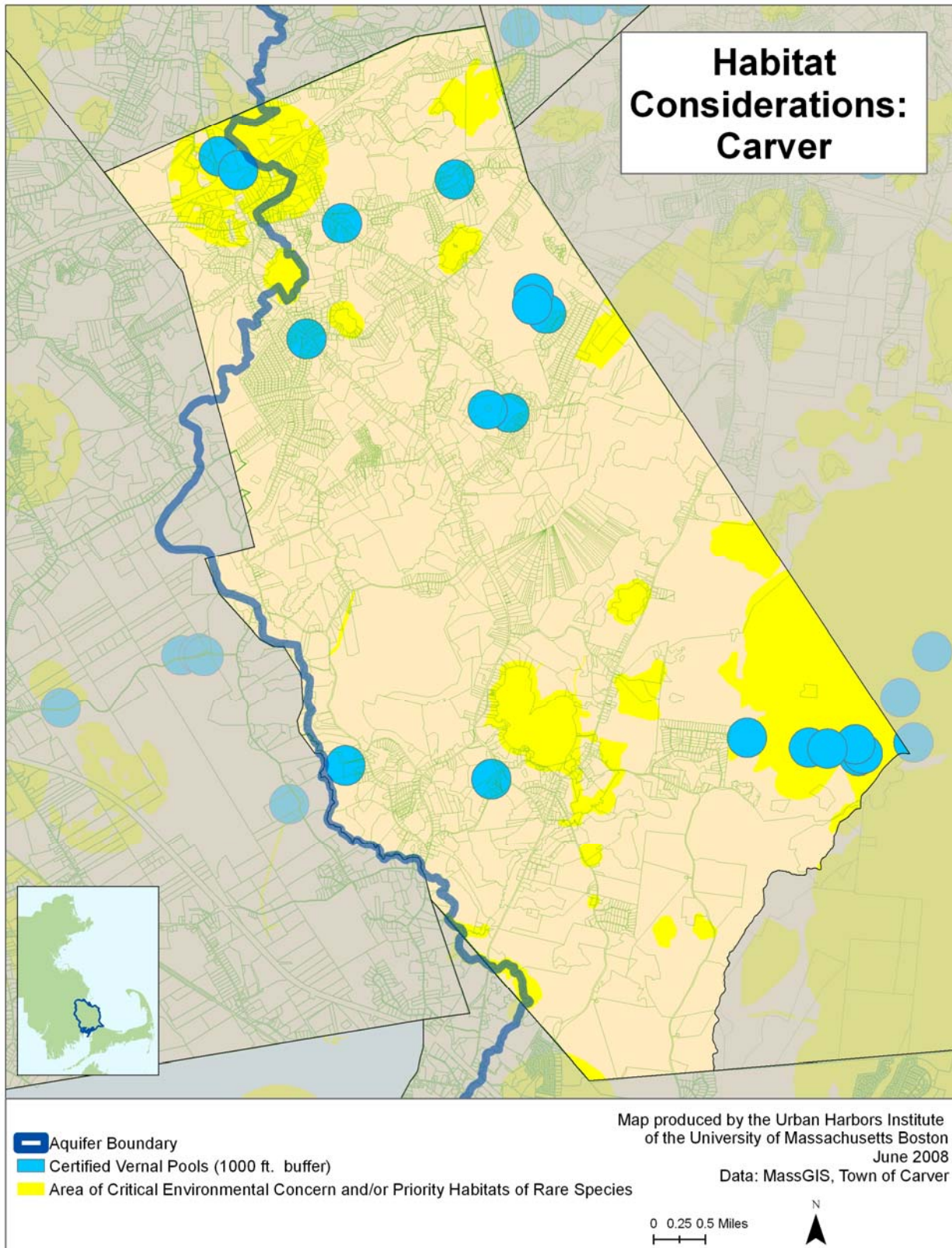


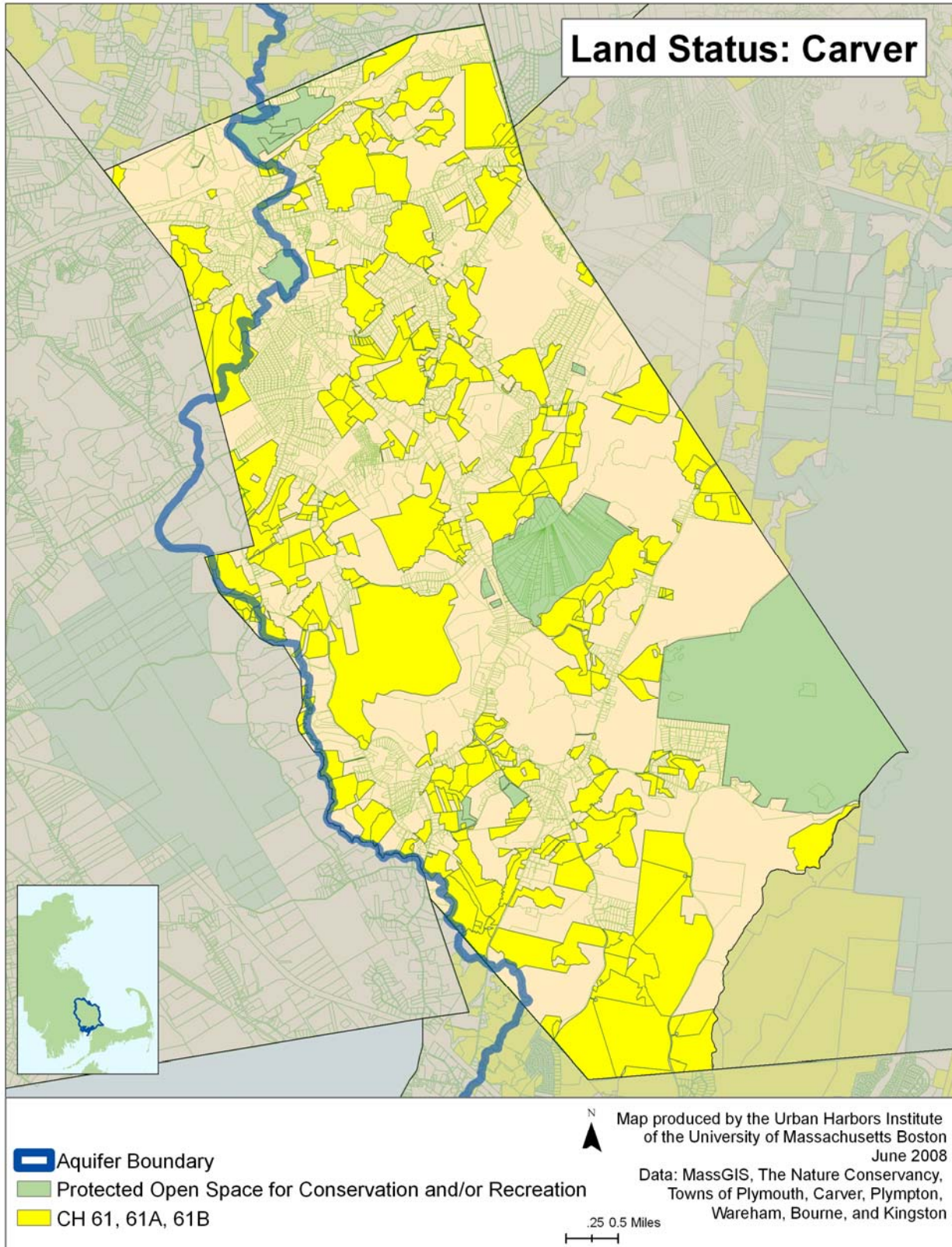


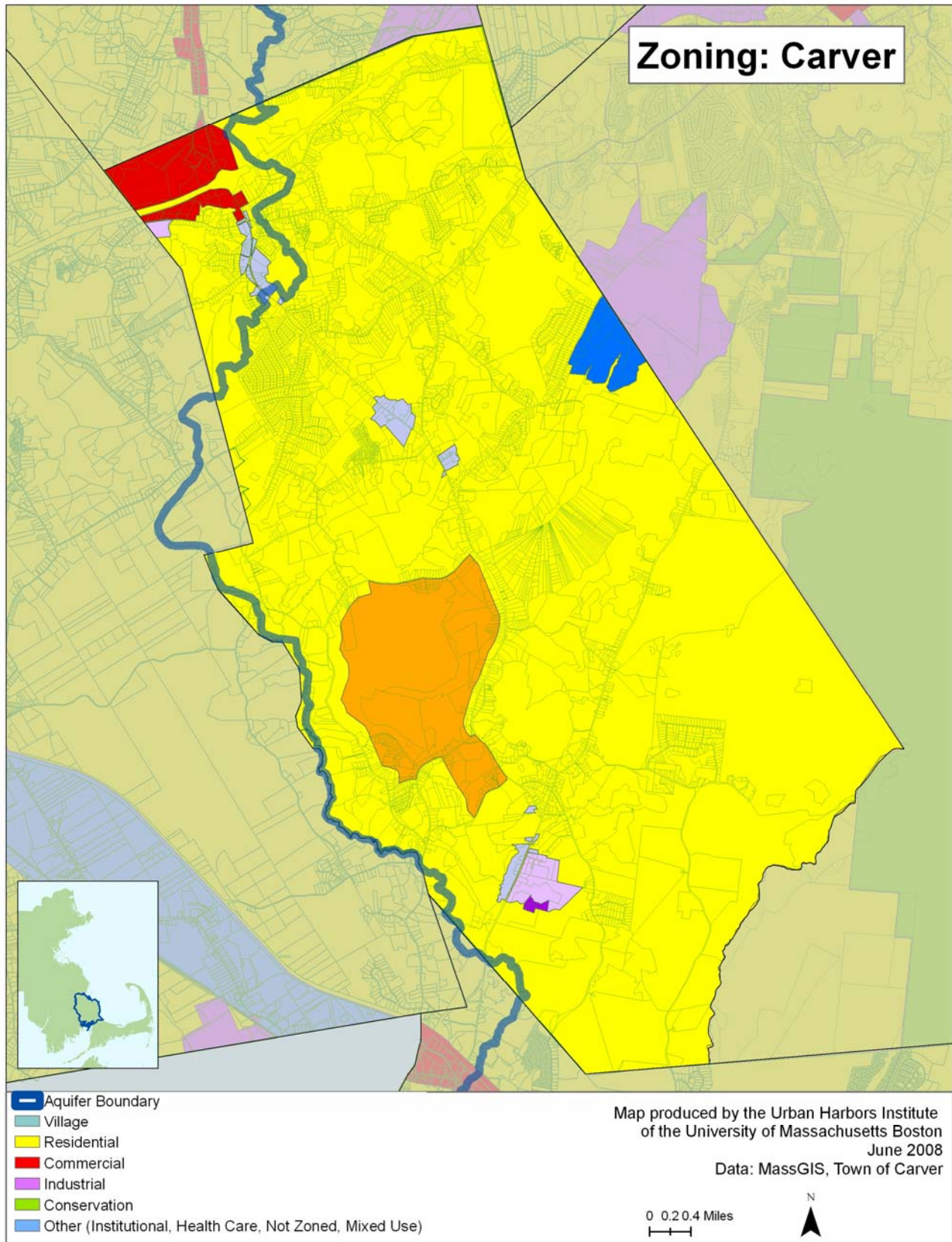


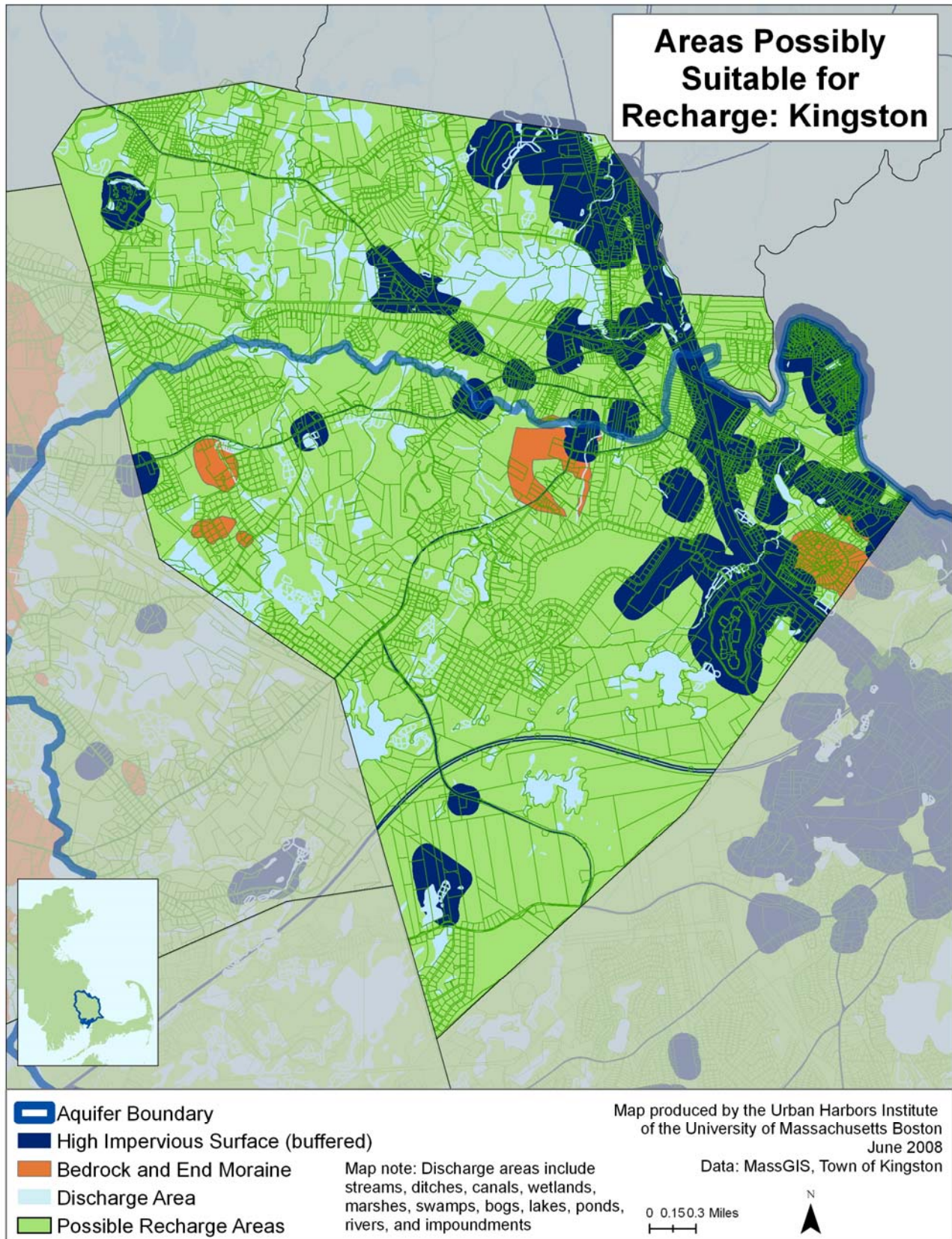




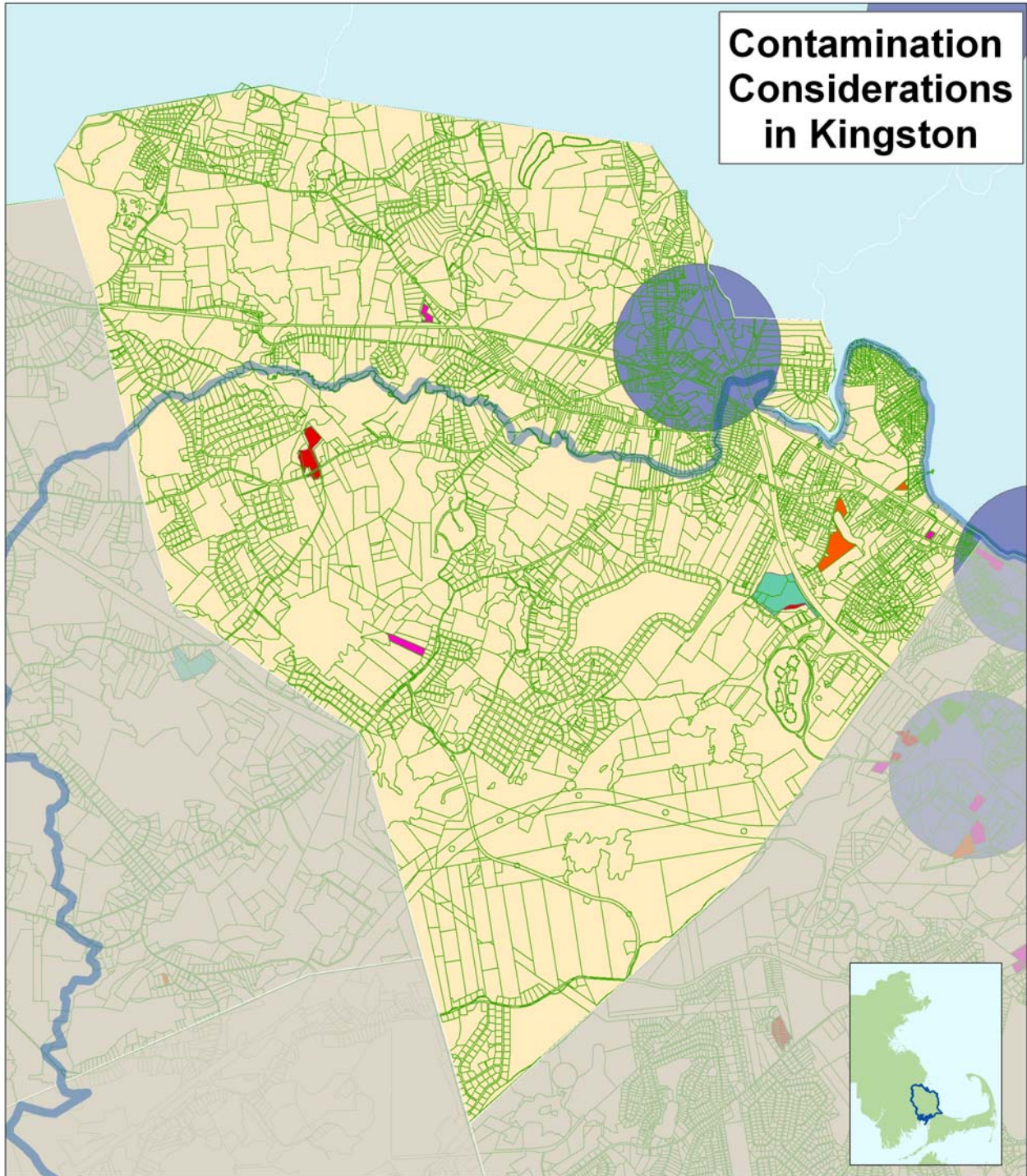








Contamination Considerations in Kingston



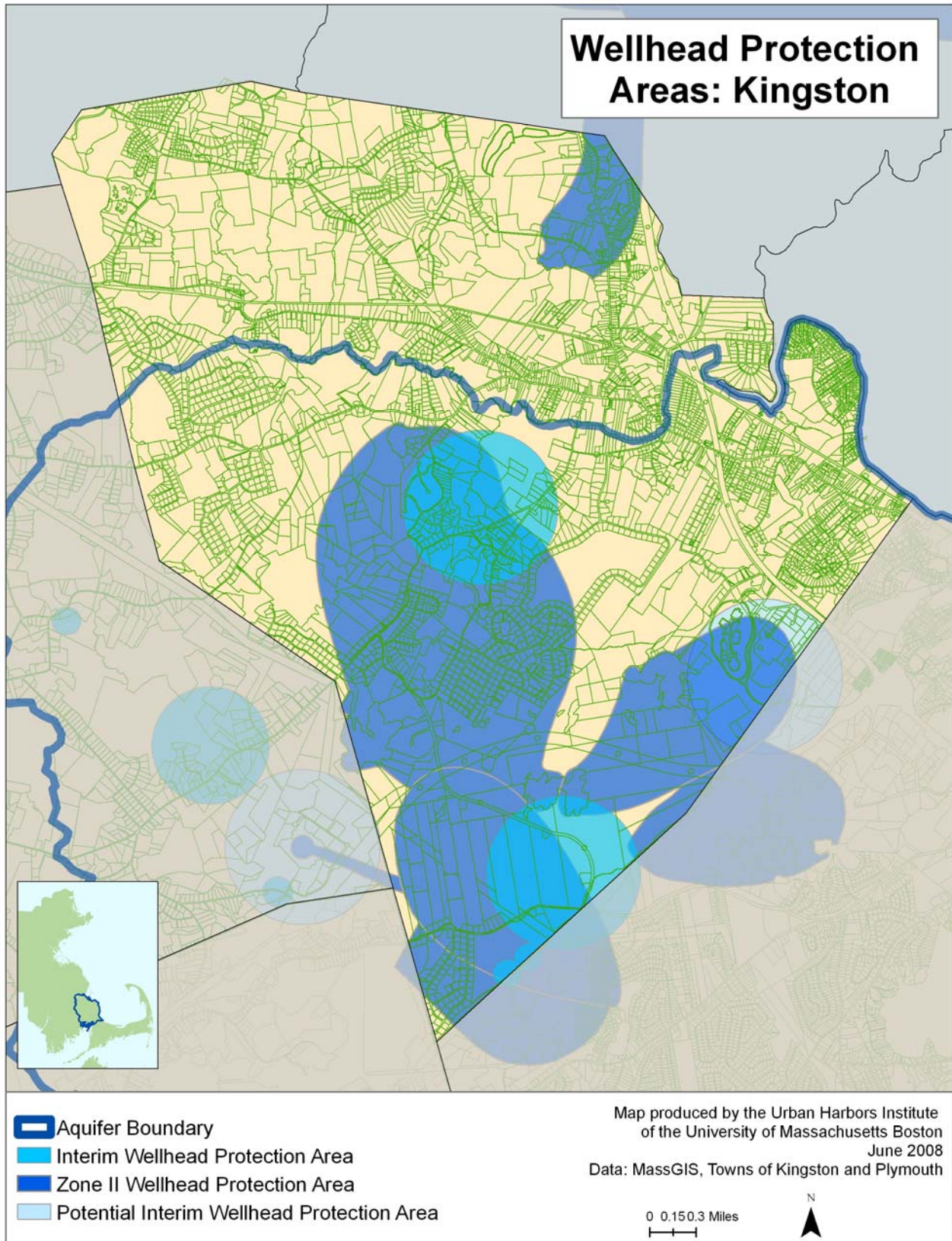
- Aquifer Boundary
- 21 E Site
- Bureau of Waste Prevention Site
- Landfill
- Hazardous Waste Disposal Site
- Contaminated Site with Activity and Use Limitations (.5 mi buffer)

Map Produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS, Town of Kingston

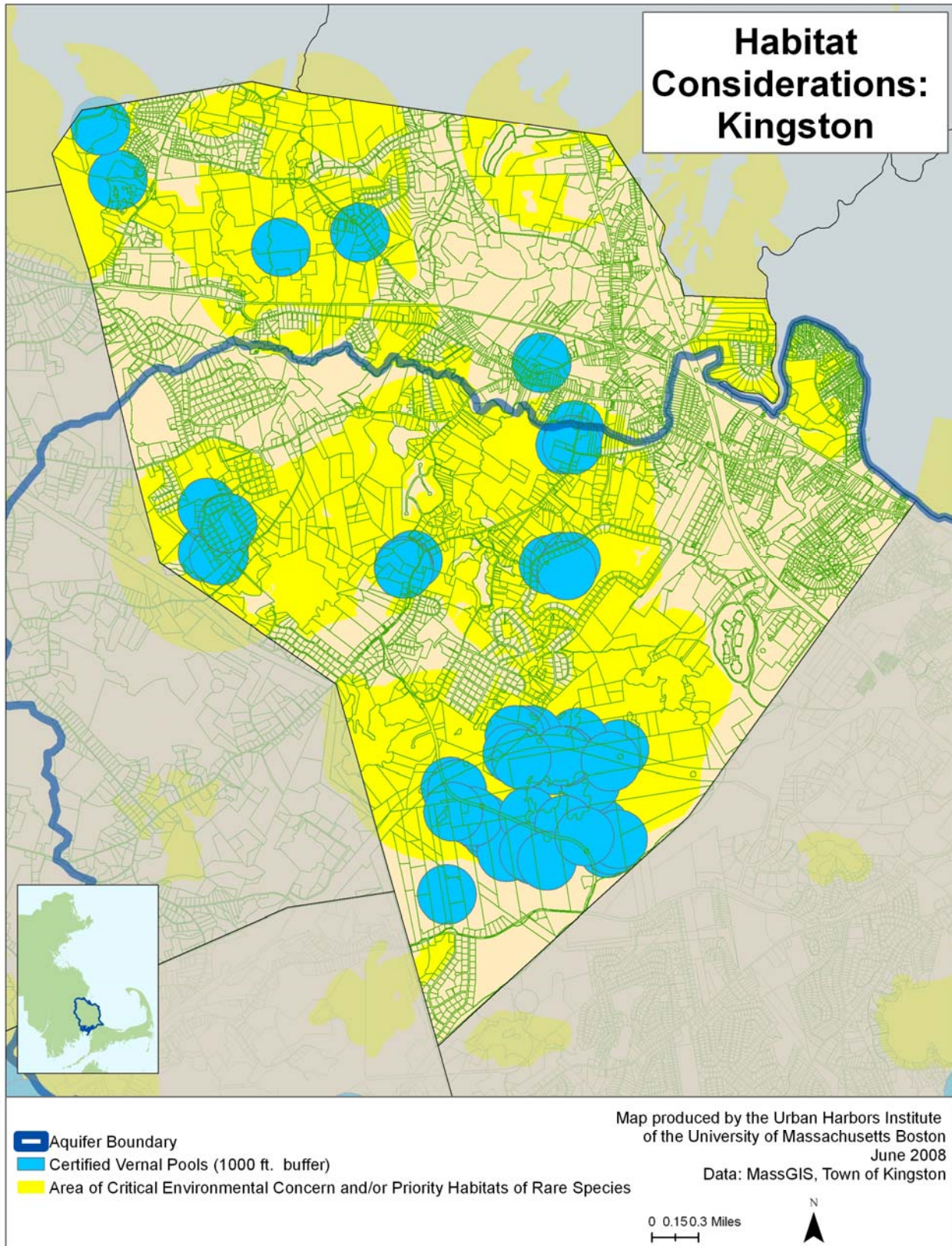
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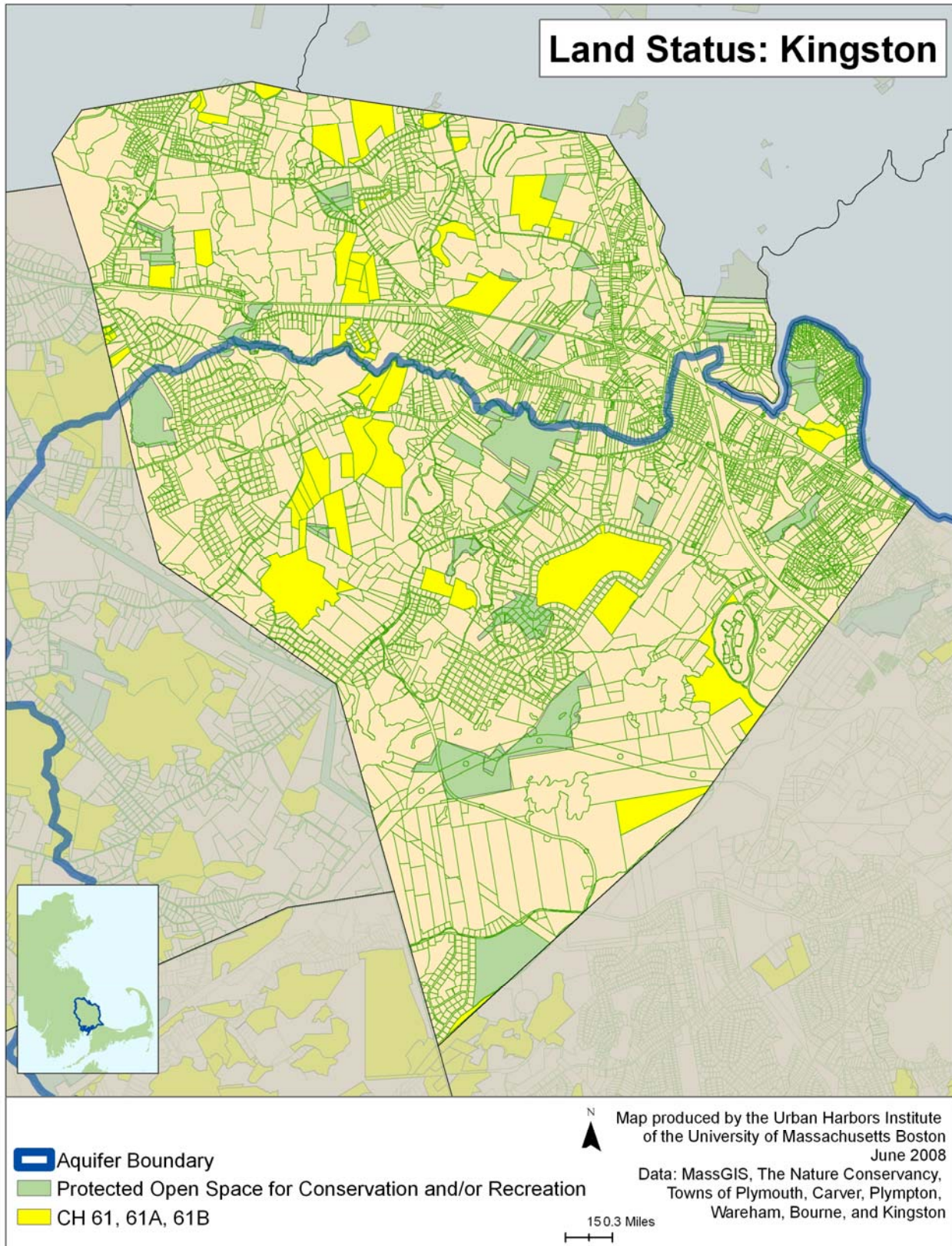
Wellhead Protection Areas: Kingston



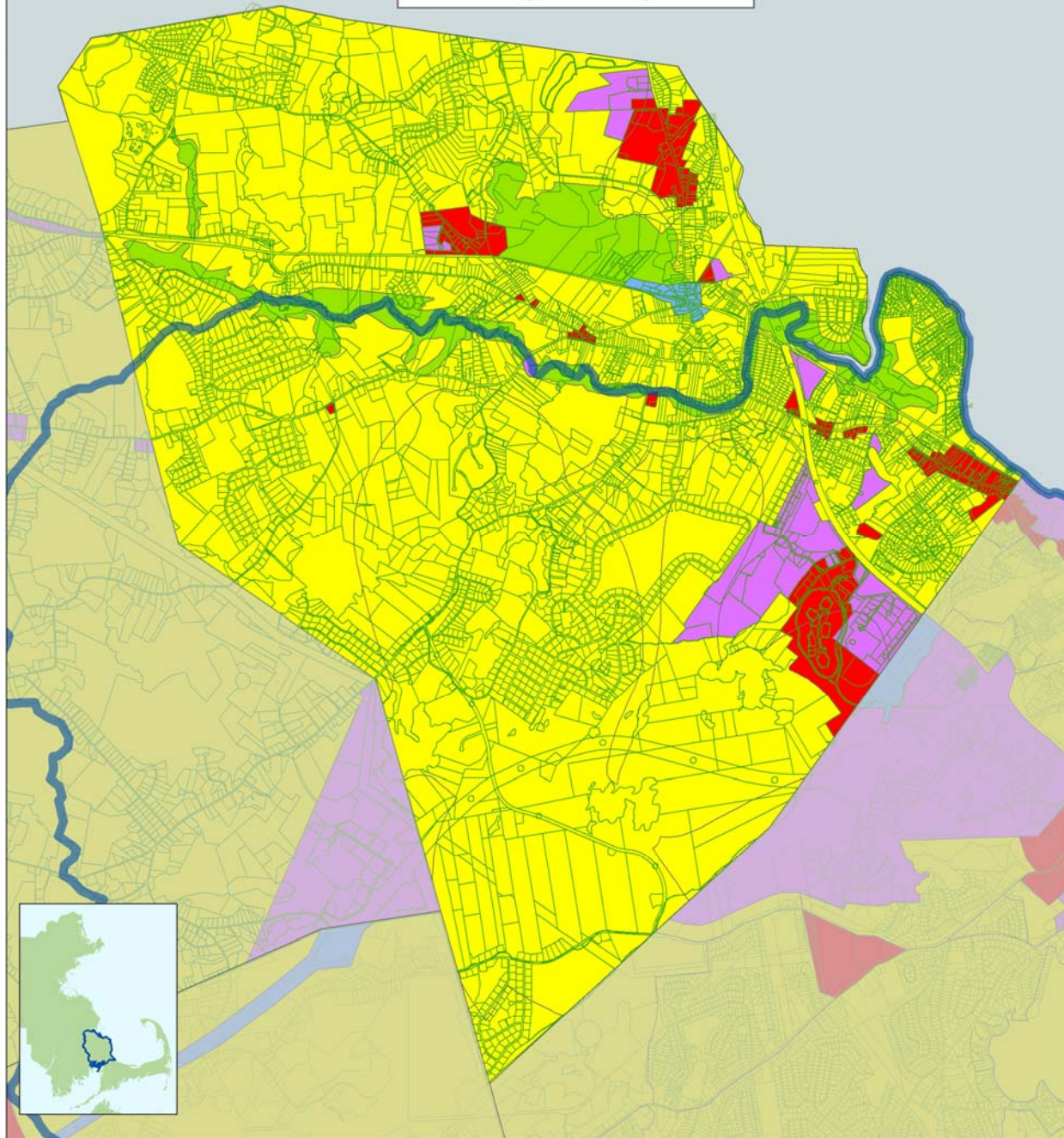
Habitat Considerations: Kingston




Land Status: Kingston





Zoning: Kingston




 Aquifer Boundary

 Residential

 Commercial

 Industrial

 Conservation

 Other (Institutional, Health Care, Not Zoned, Mixed Use)

Zoning is not uniform across towns, therefore this map shows general zoning as classified by MassGIS.

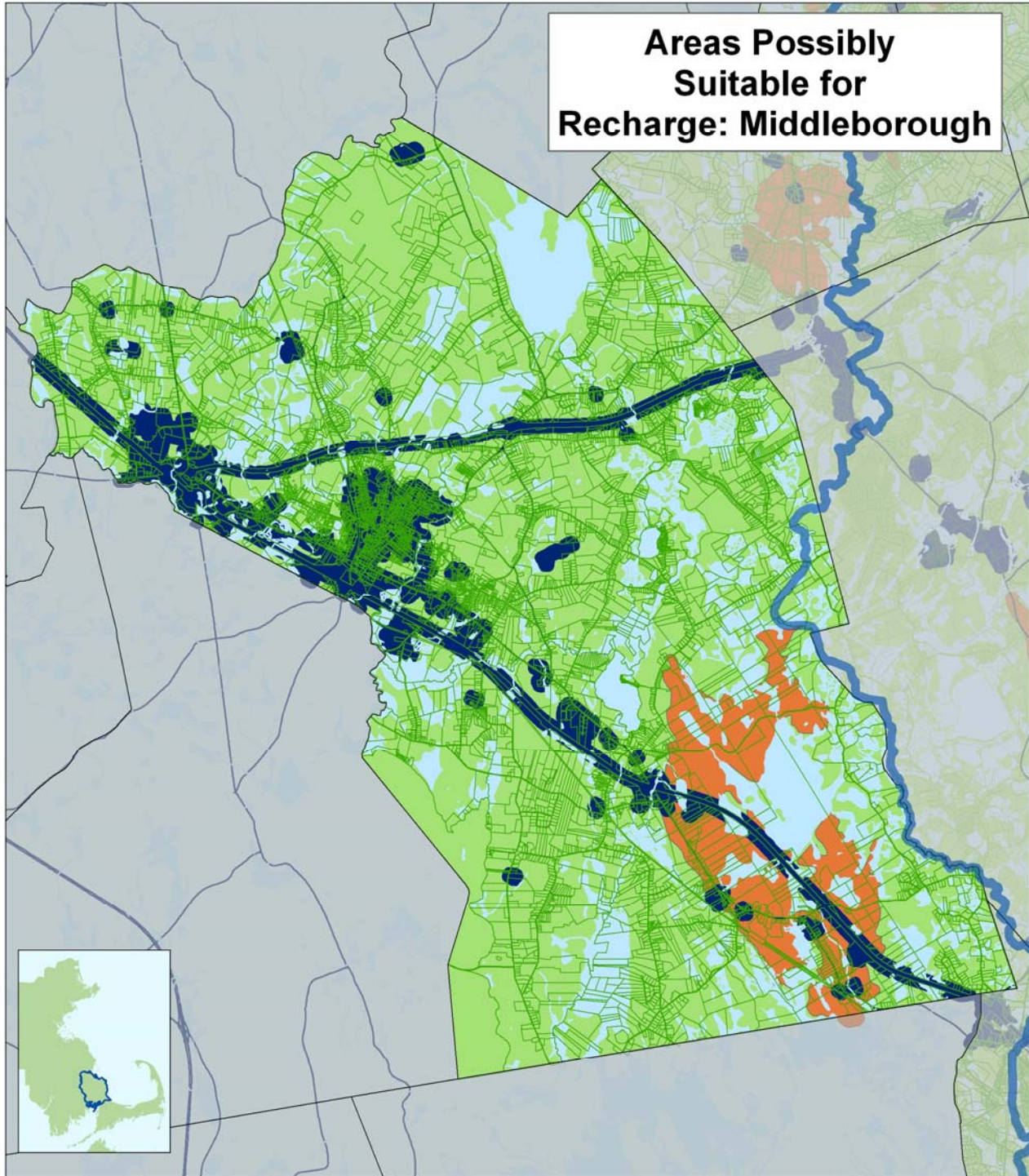
Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008

Data: MassGIS, Town of Kingston

0 0.150,3 Miles



Areas Possibly Suitable for Recharge: Middleborough



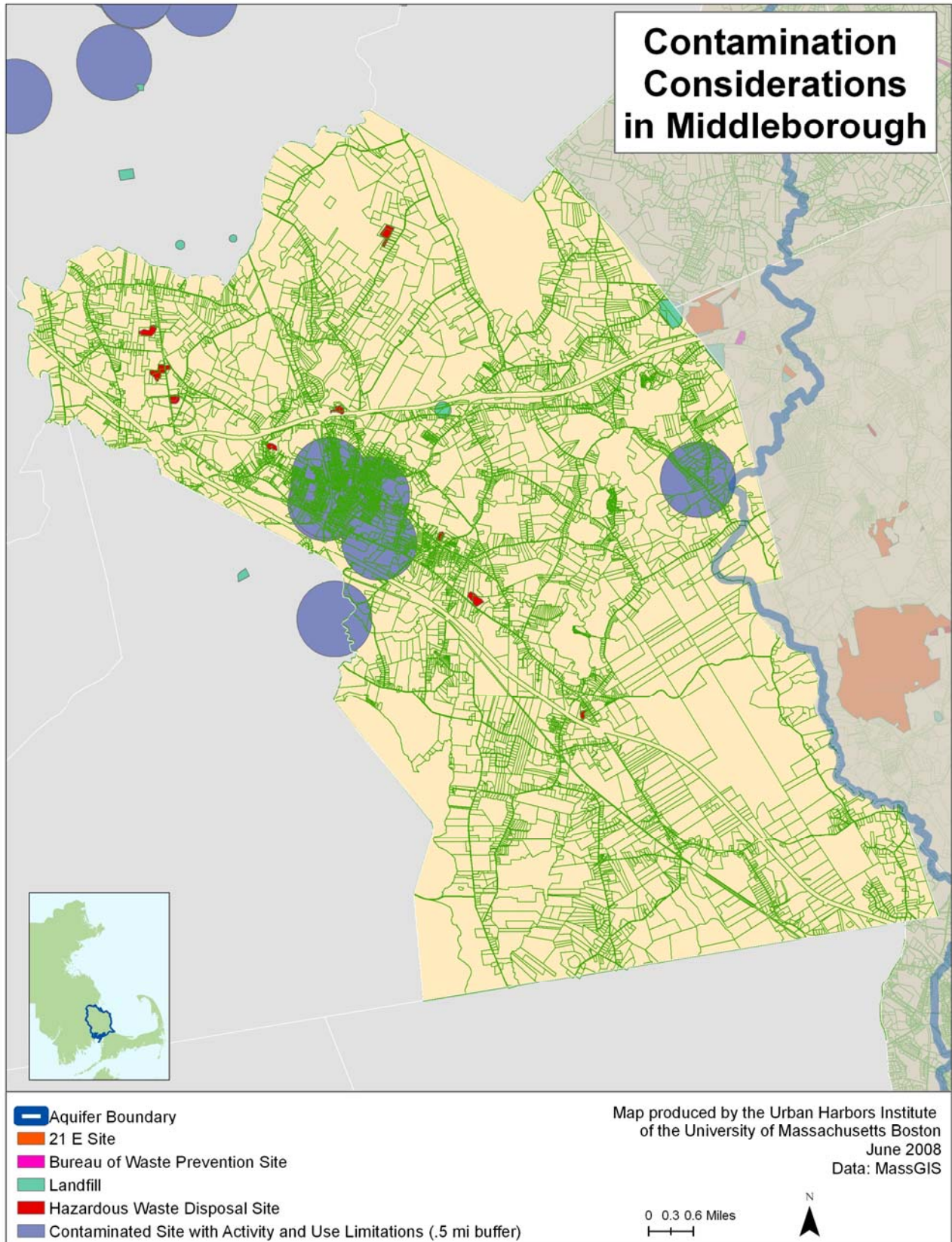
- Aquifer Boundary
- High Impervious Surface (buffered)
- Bedrock and End Moraine
- Discharge Area
- Possible Recharge Areas

Map note: Discharge areas include streams, ditches, canals, wetlands, marshes, swamps, bogs, lakes, ponds, rivers, and impoundments

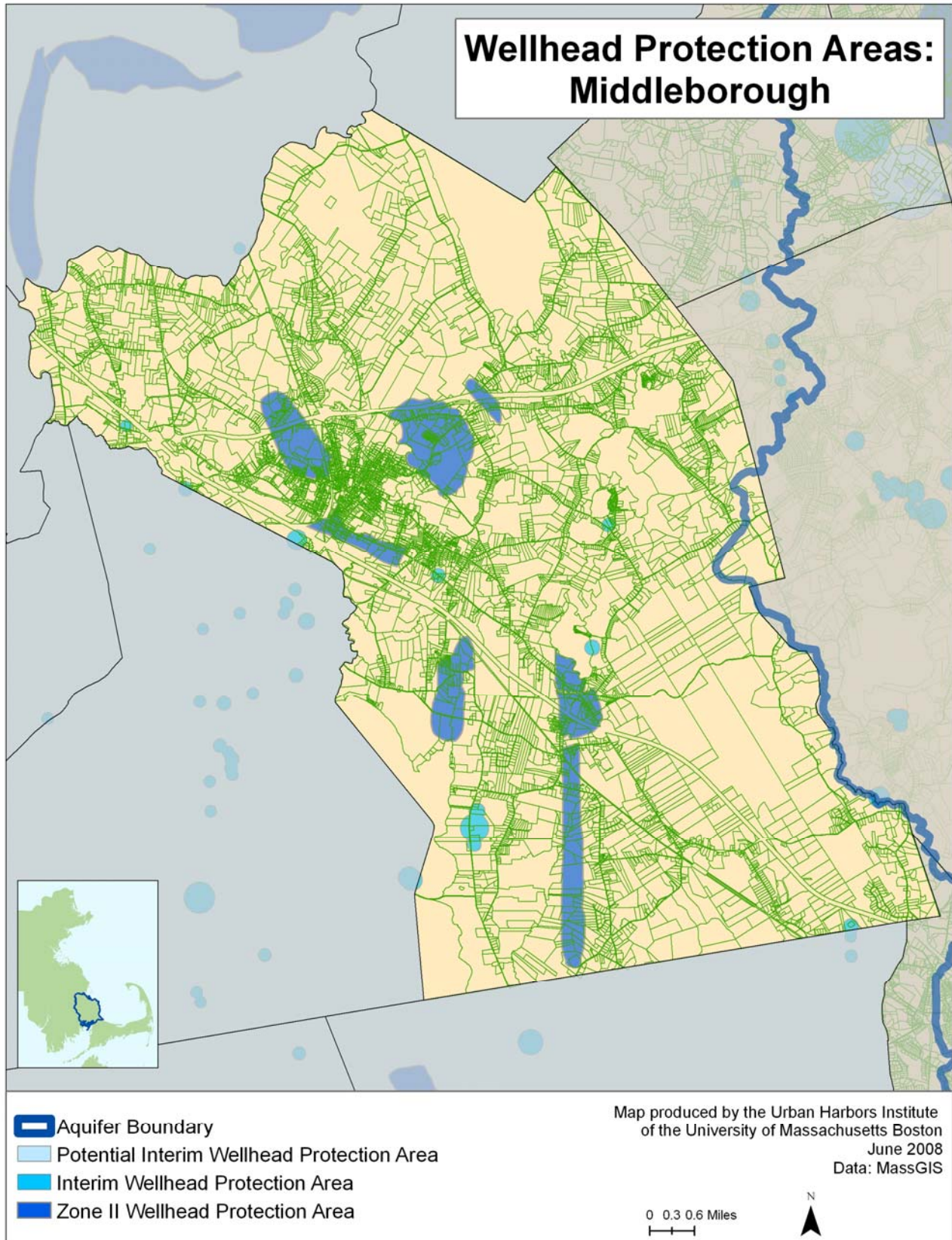
Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS

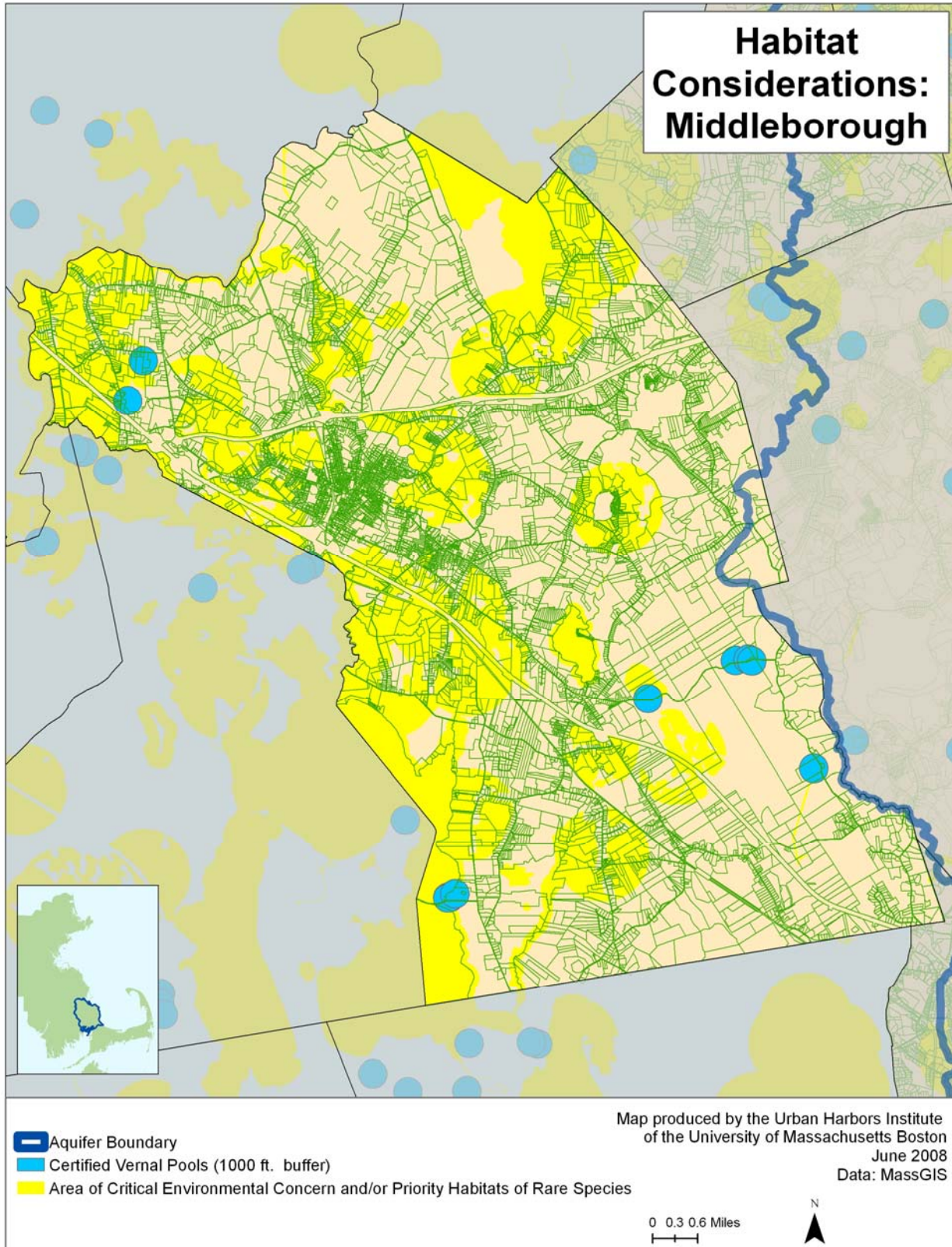
0 0.3 0.6 Miles





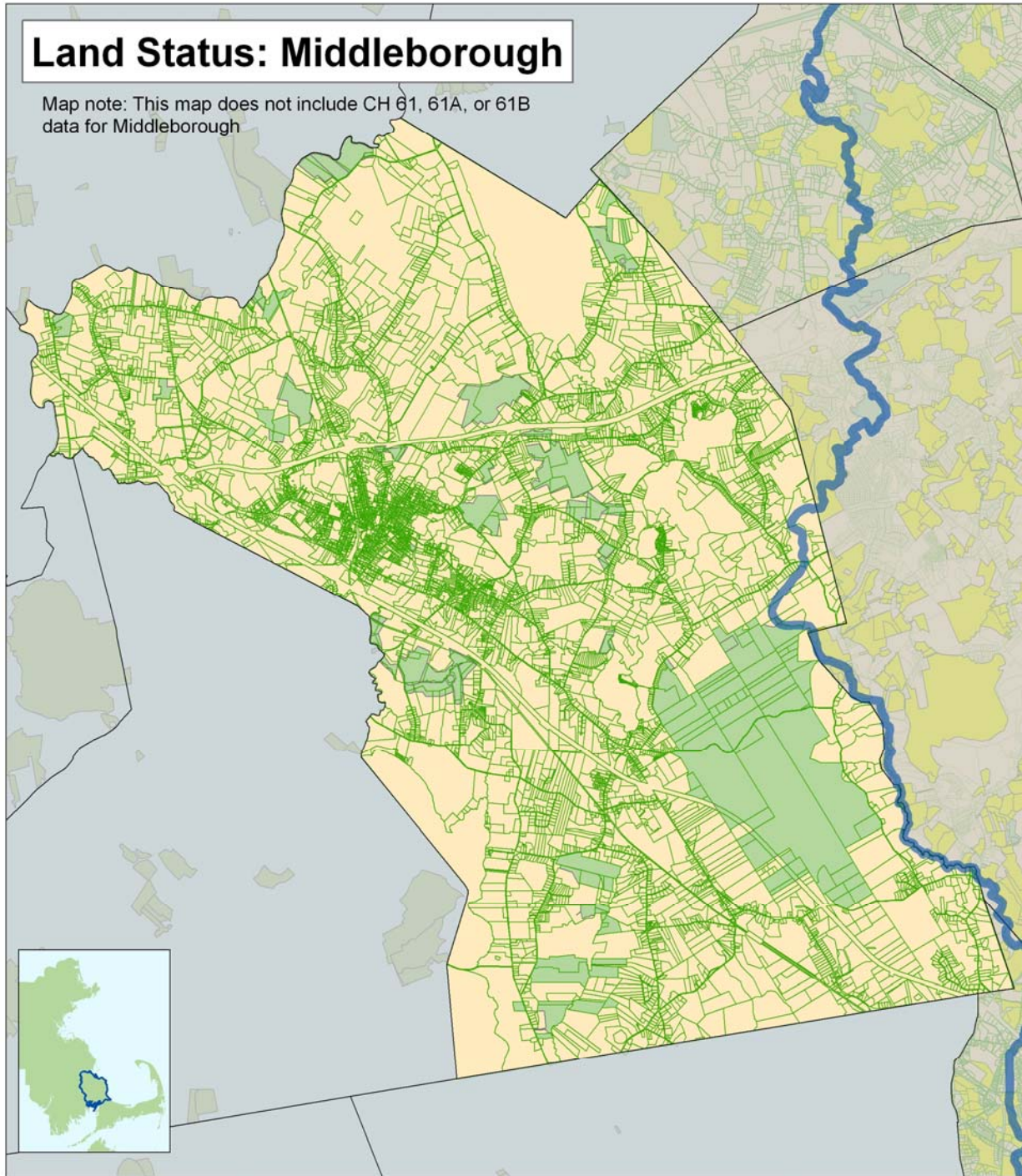
Wellhead Protection Areas: Middleborough







Land Status: Middleborough

Map note: This map does not include CH 61, 61A, or 61B data for Middleborough



 Aquifer Boundary


 Protected Open Space for Conservation and/or Recreation

 CH 61, 61A, 61B

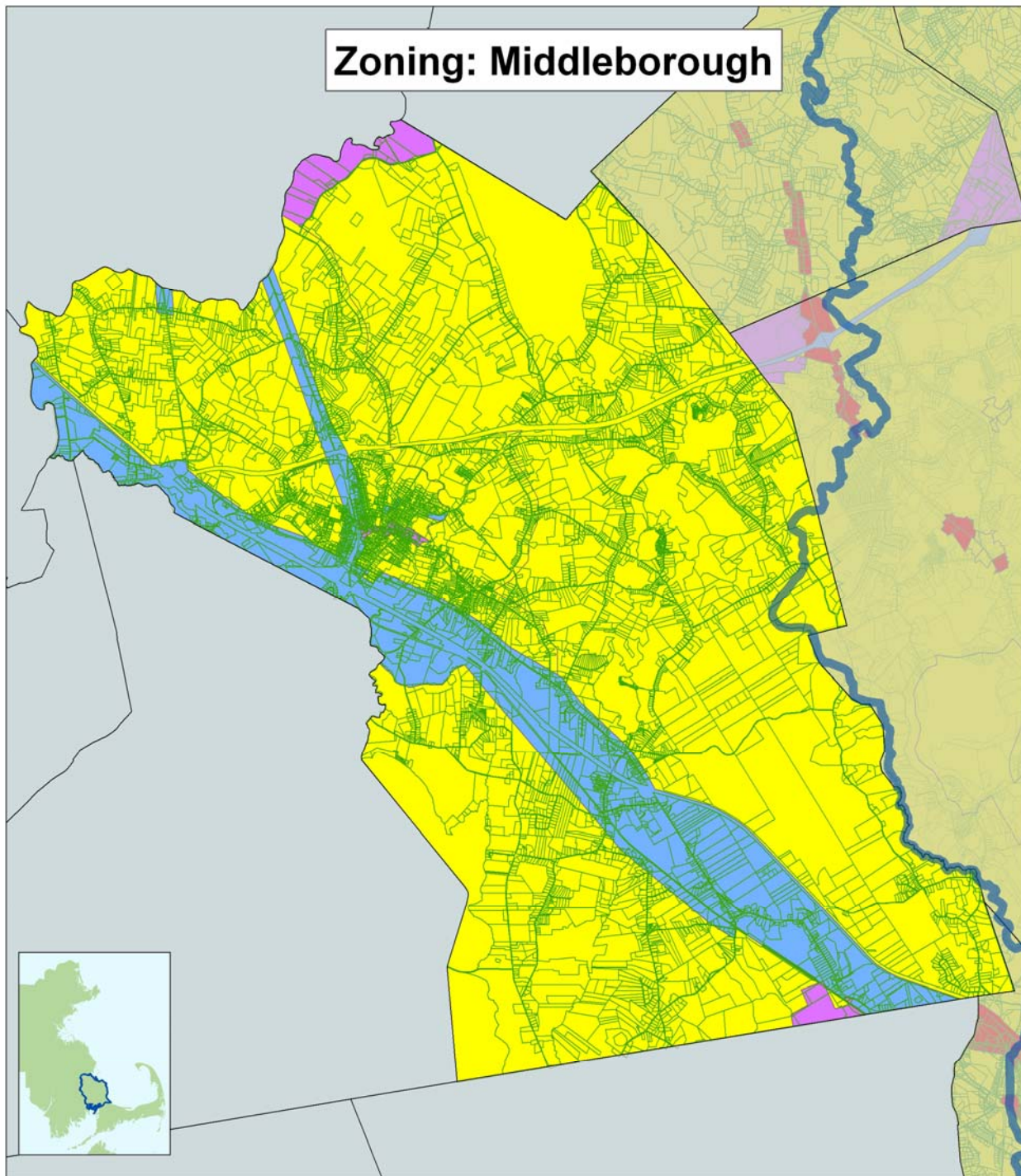


Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008

Data: MassGIS, The Nature Conservancy,
Towns of Plymouth, Carver, Plympton,
Wareham, Bourne, and Kingston

0.3 0.6 Miles


Zoning: Middleborough



- Aquifer Boundary
- Residential
- Commercial
- Industrial
- Conservation
- Other (Institutional, Health Care, Not Zoned, Mixed Use)

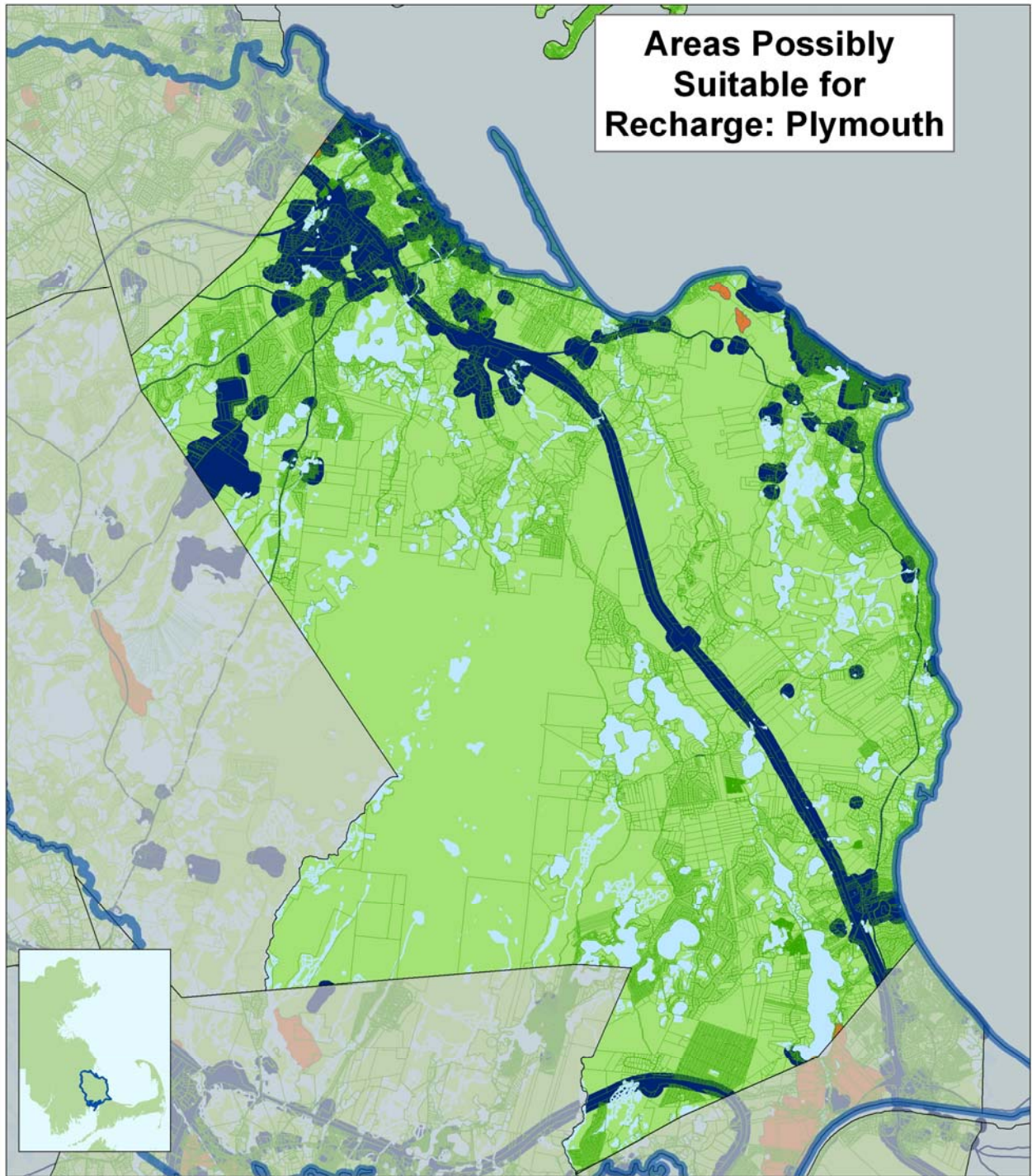
Zoning is not uniform across towns, therefore this map shows general zoning as classified by MassGIS.

Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS

0 0.3 0.6 Miles



Areas Possibly Suitable for Recharge: Plymouth



Aquifer Boundary

High Impervious Surface (buffered)

Bedrock and End Moraine

Discharge Area

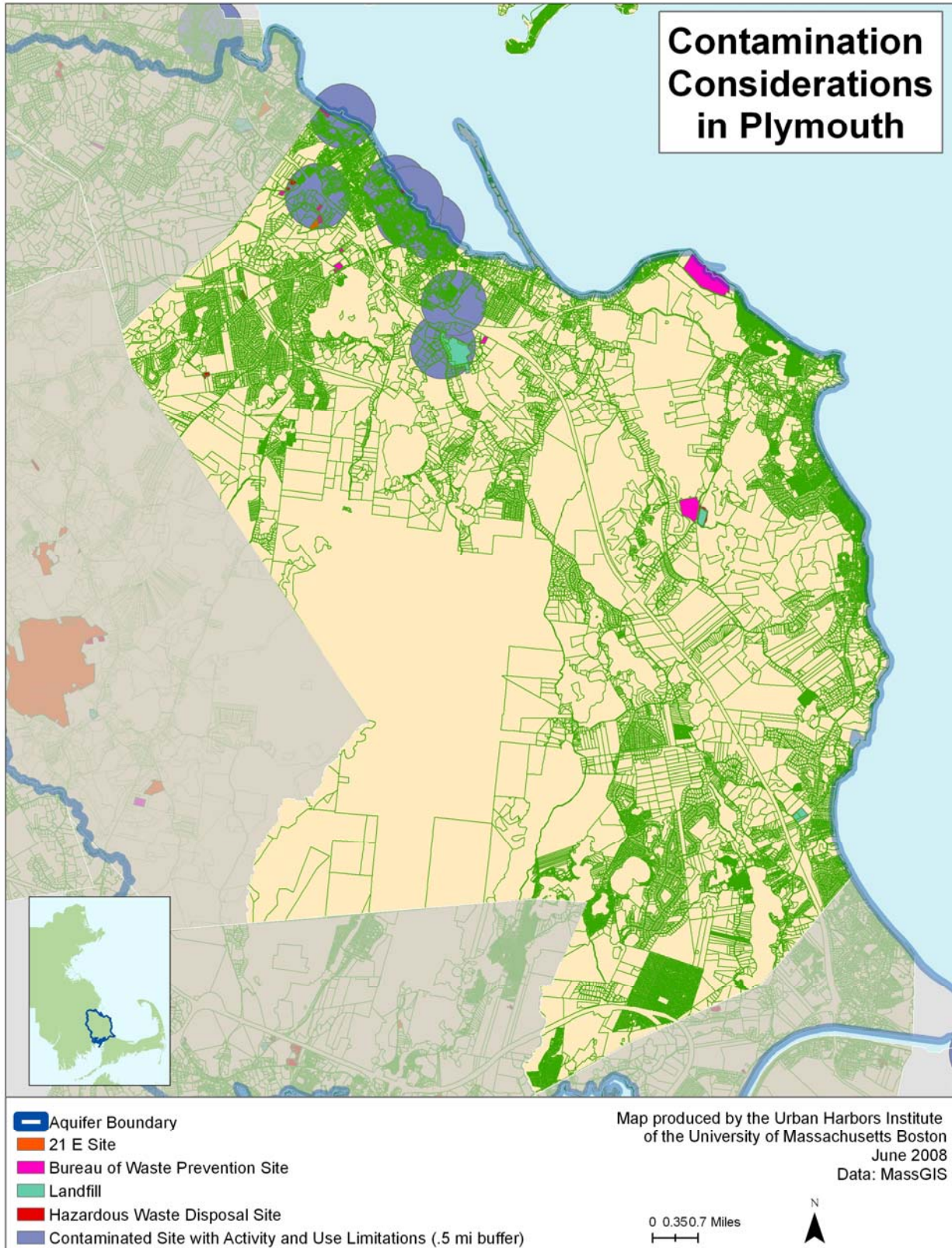
Possible Recharge Areas

Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS

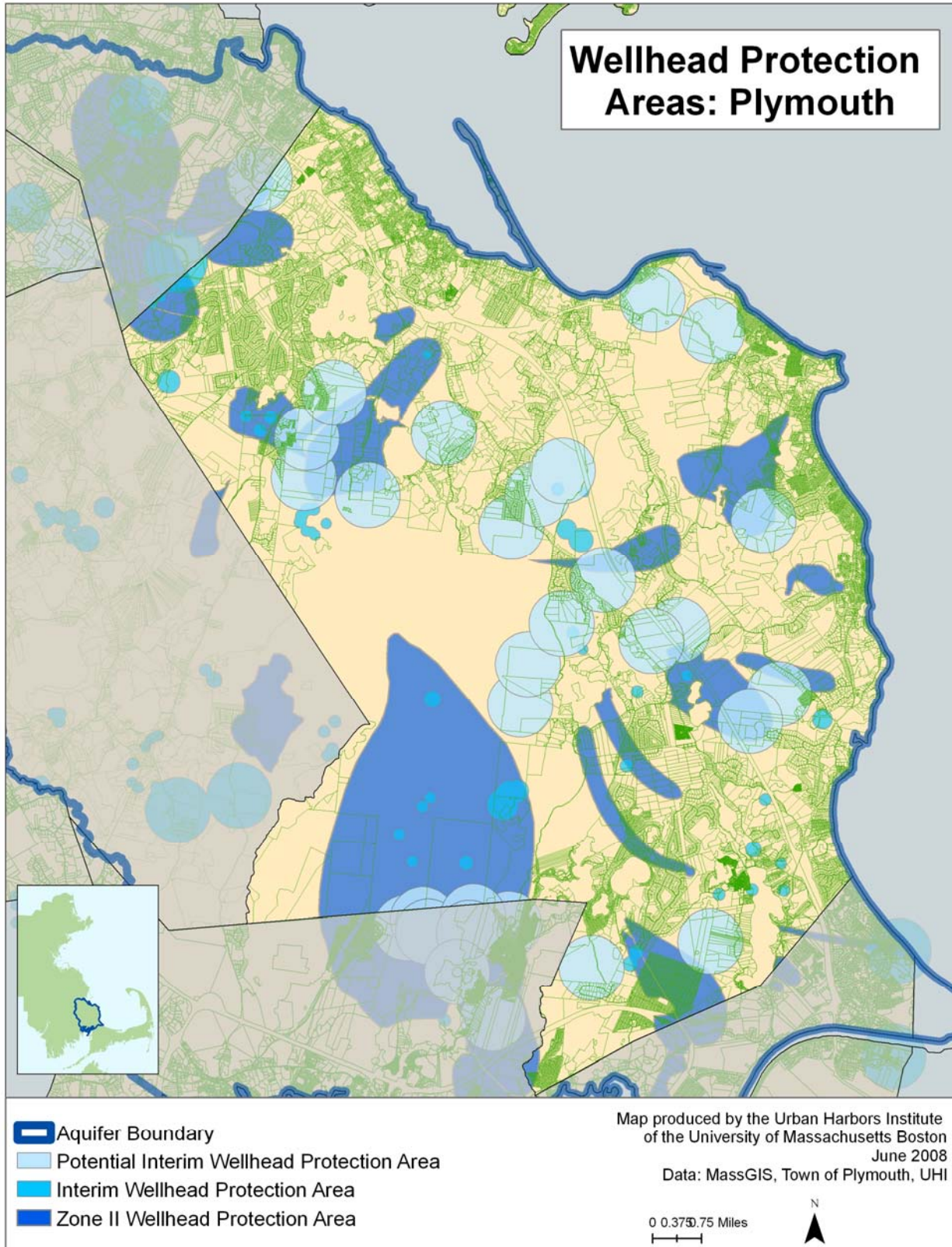
Map note: Discharge areas include
streams, ditches, canals, wetlands,
marshes, swamps, bogs, lakes, ponds,
rivers, and impoundments

0 0.35 0.7 Miles

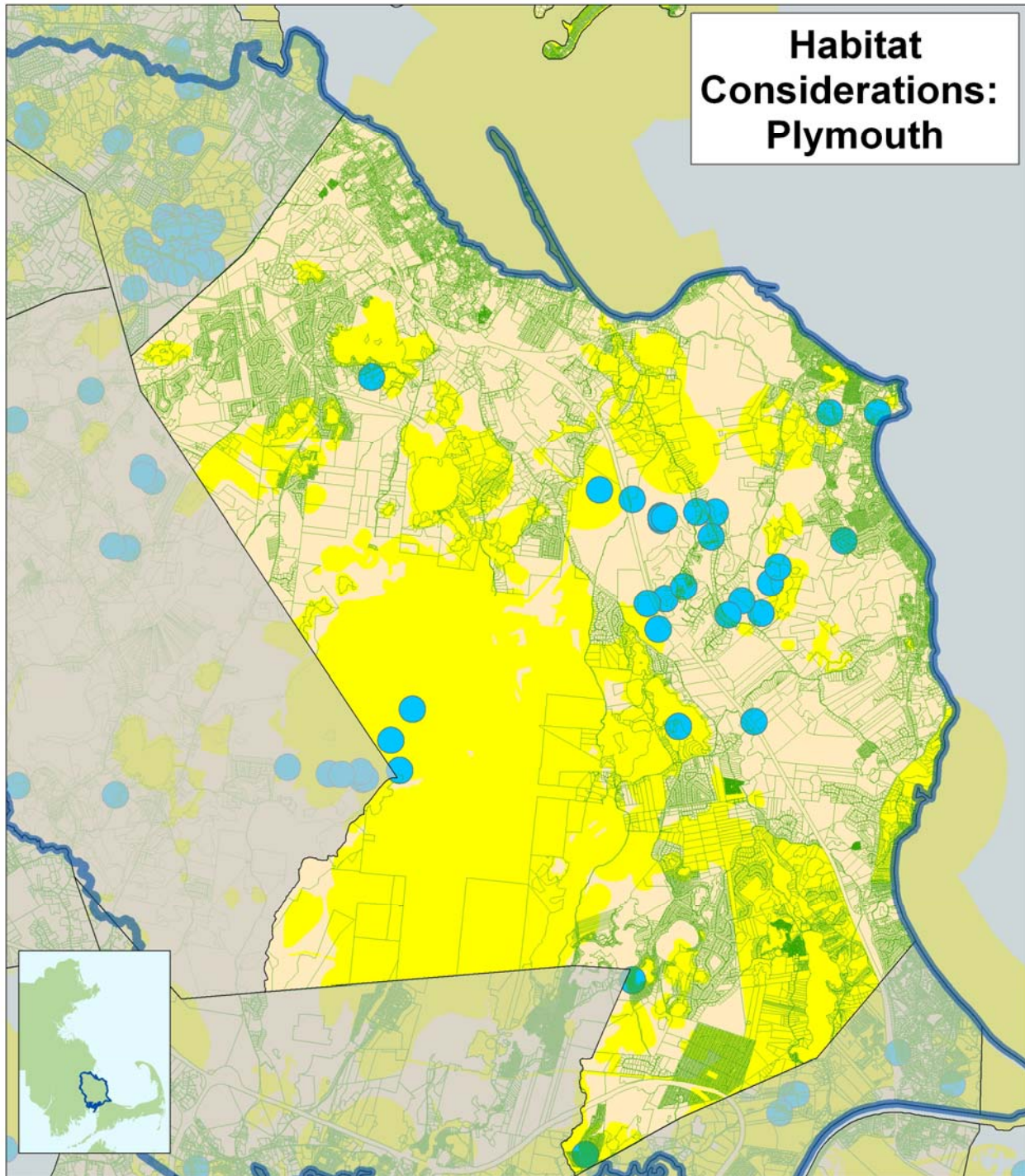
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Wellhead Protection Areas: Plymouth




Habitat Considerations: Plymouth

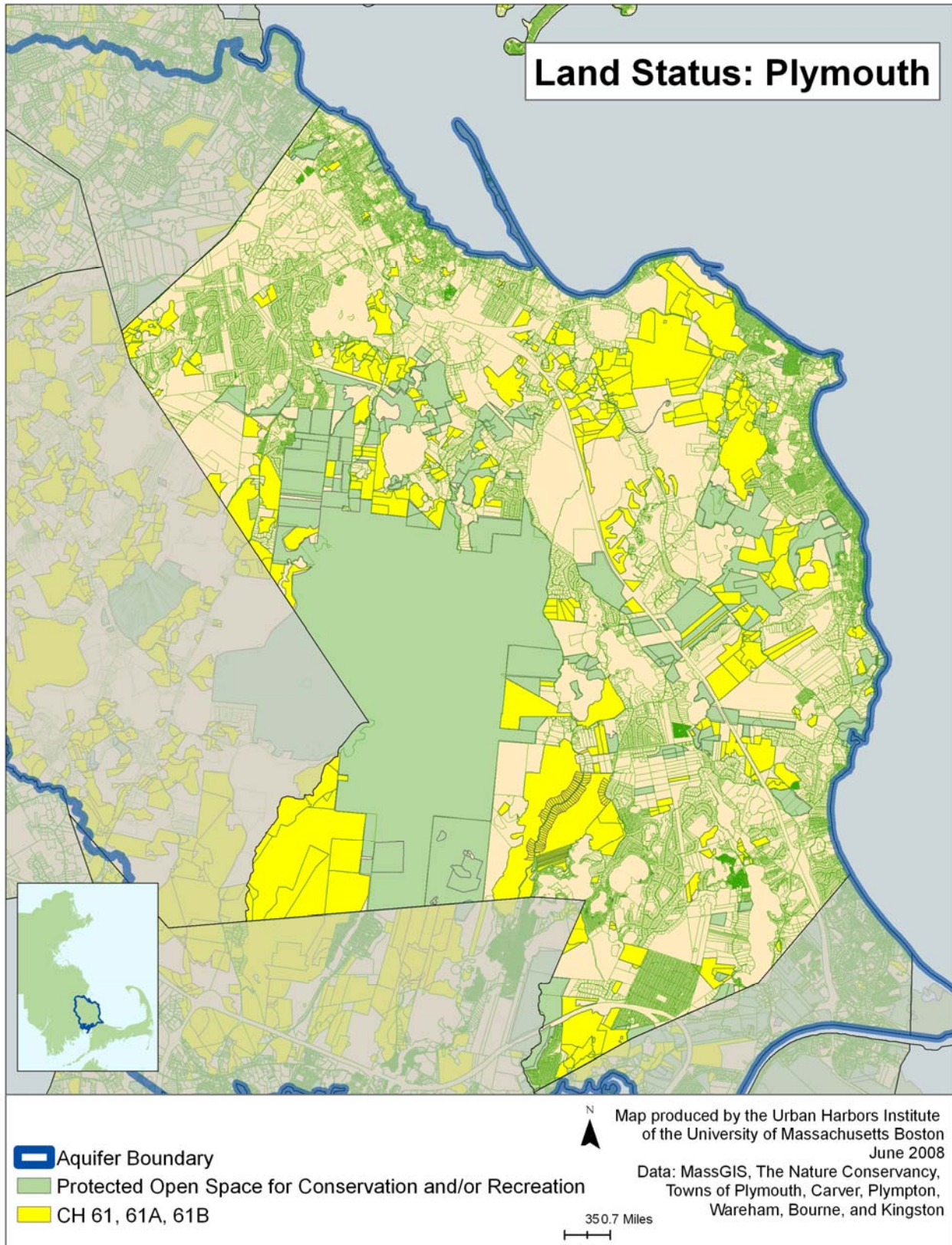


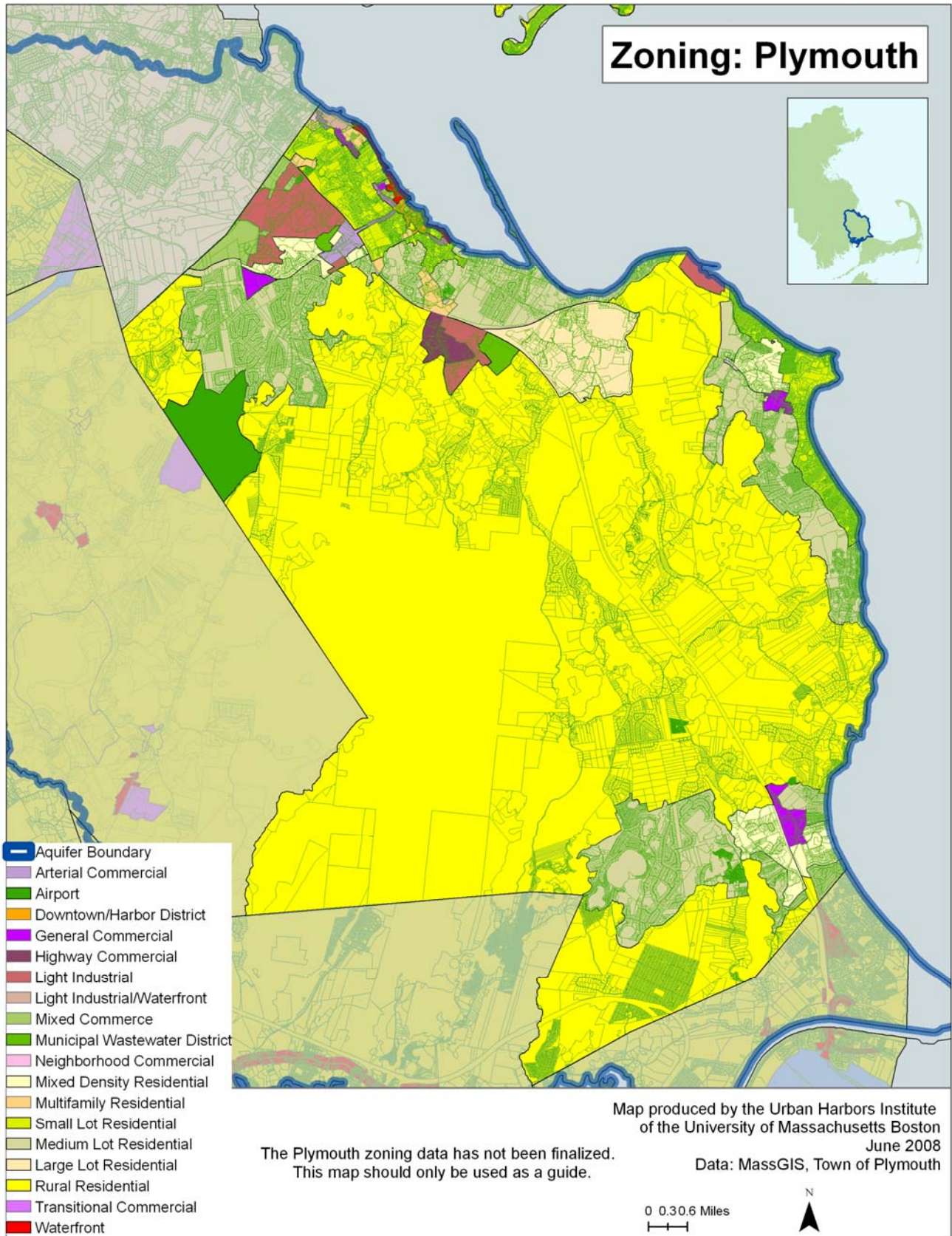
-  Aquifer Boundary
-  Certified Vernal Pools (1000 ft. buffer)
-  Area of Critical Environmental Concern and/or Priority Habitats of Rare Species

Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS

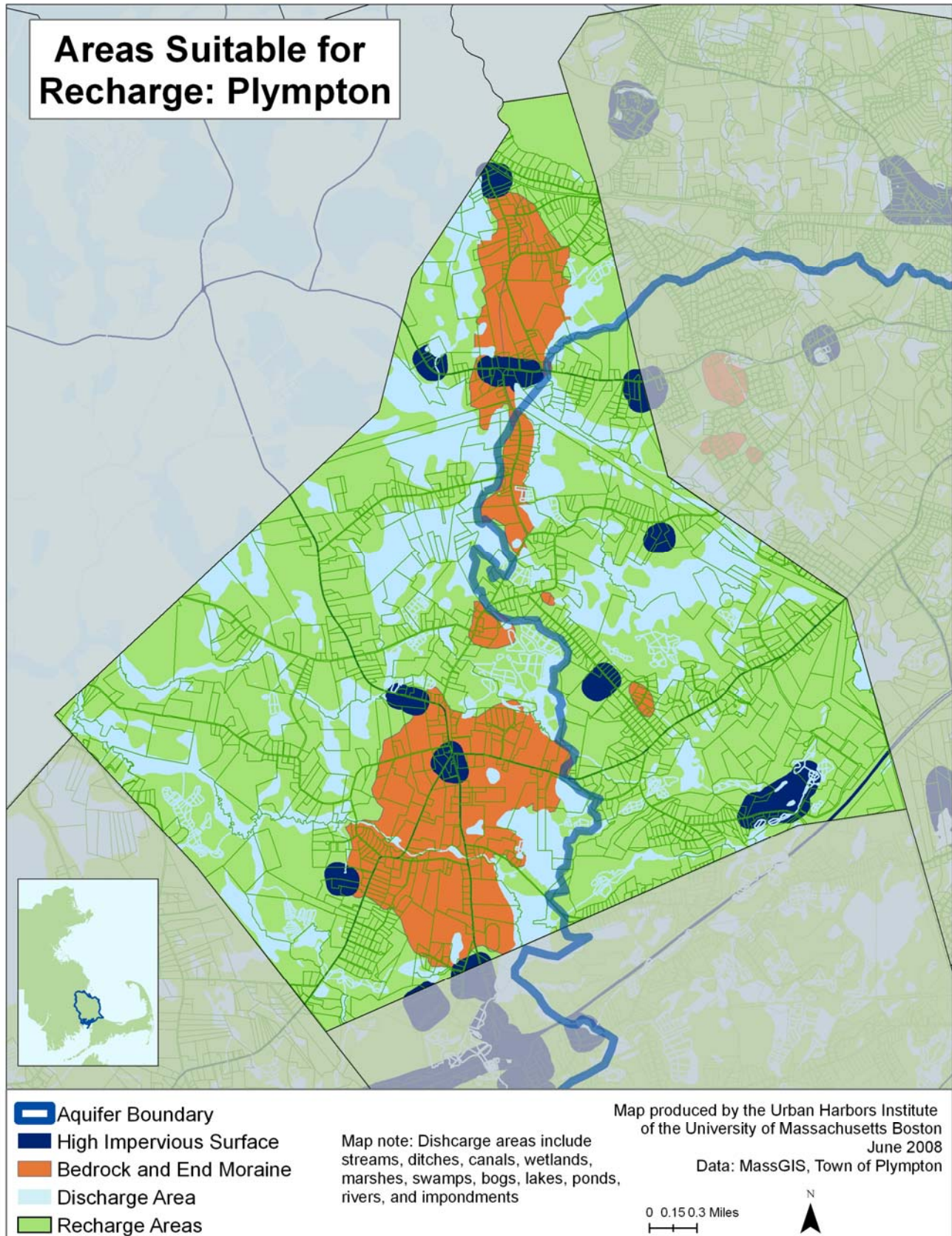
0 0.350.7 Miles




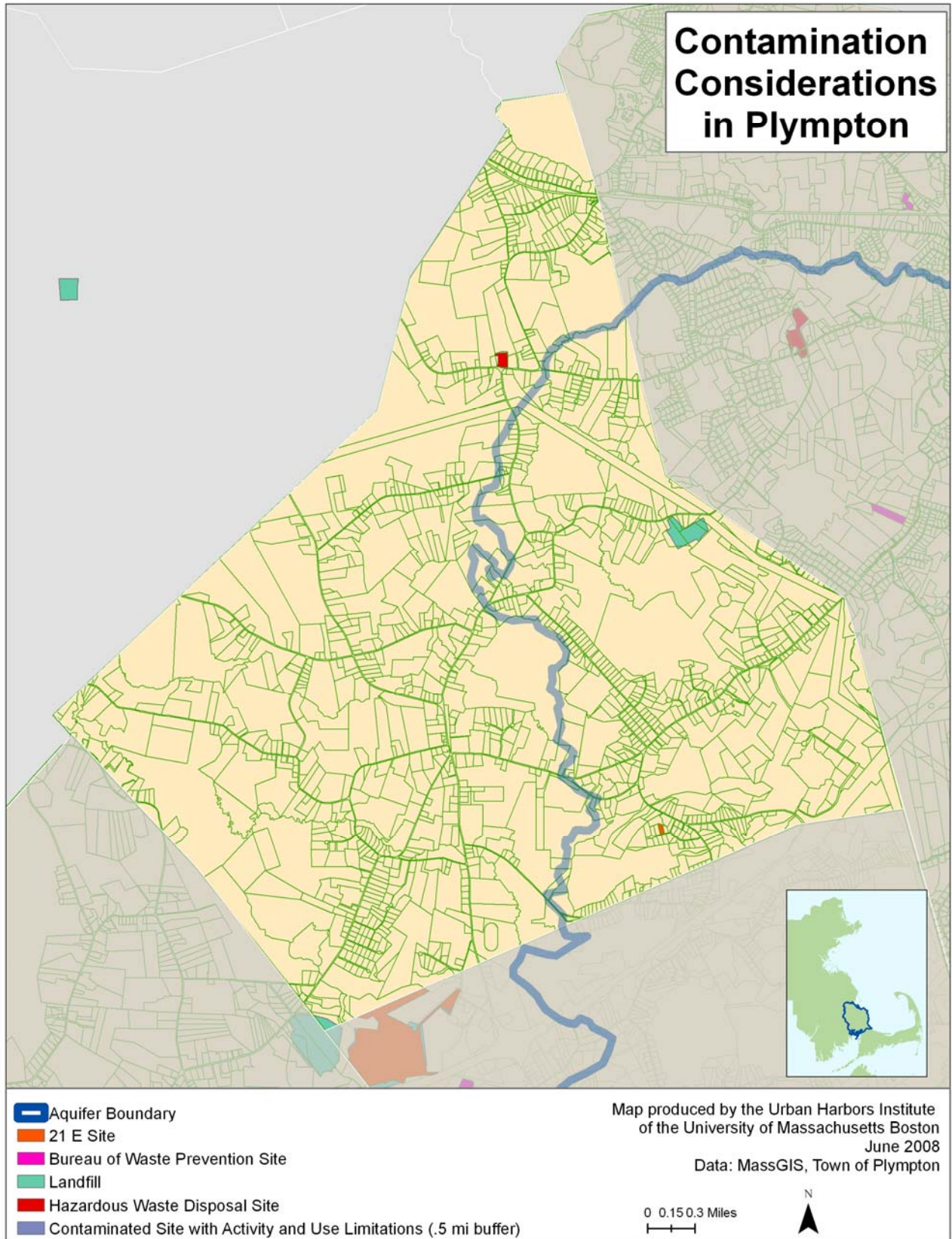


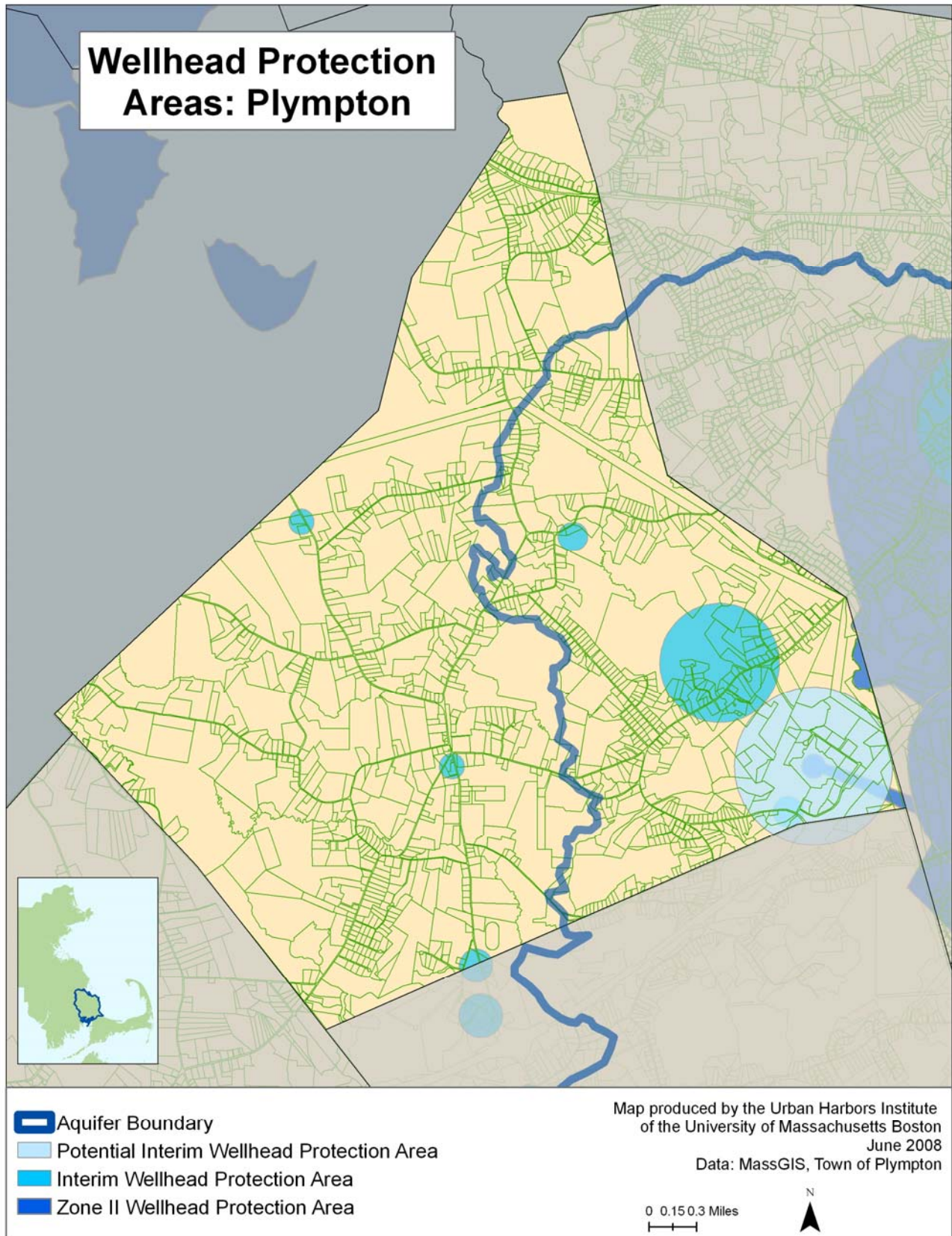


Areas Suitable for Recharge: Plympton

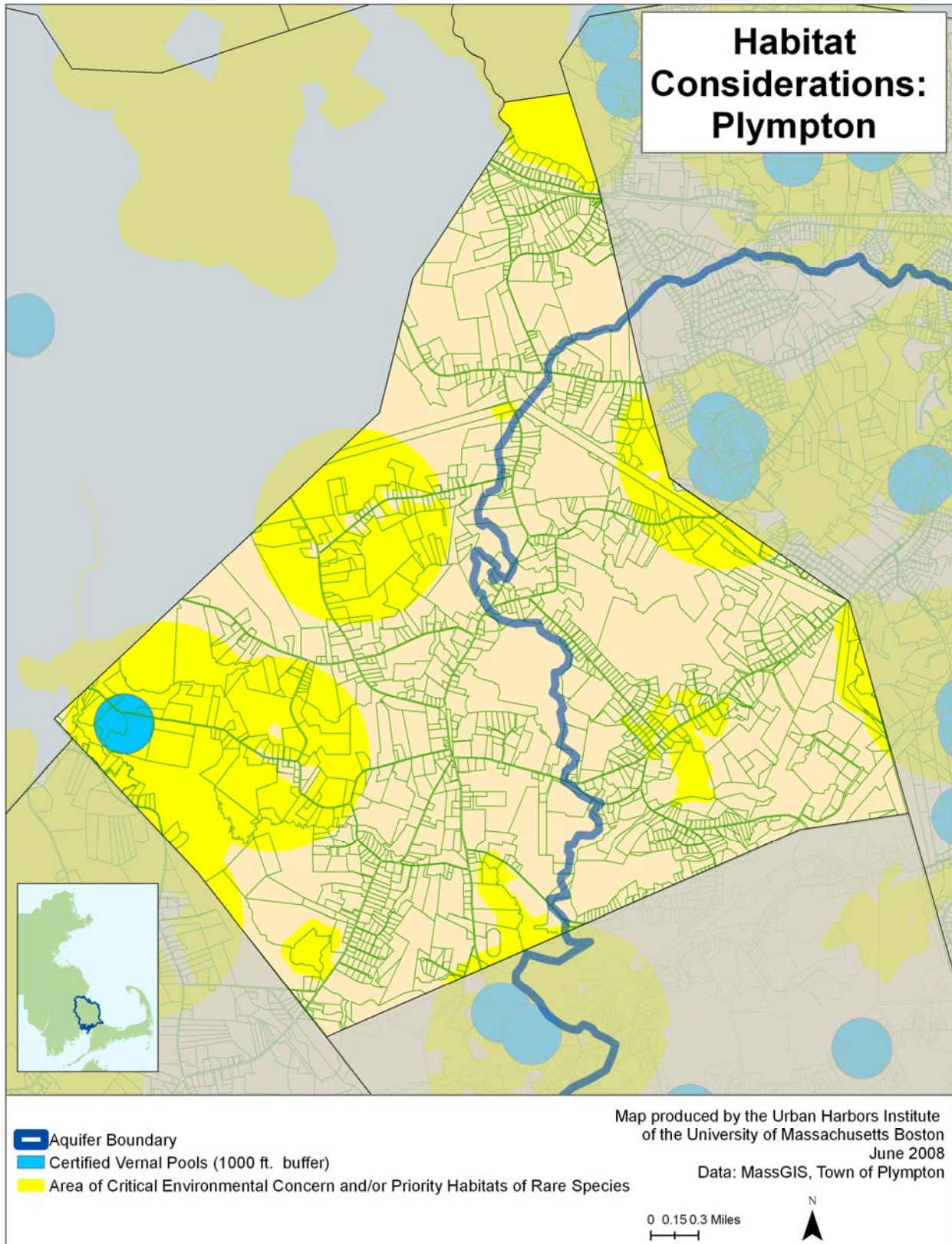


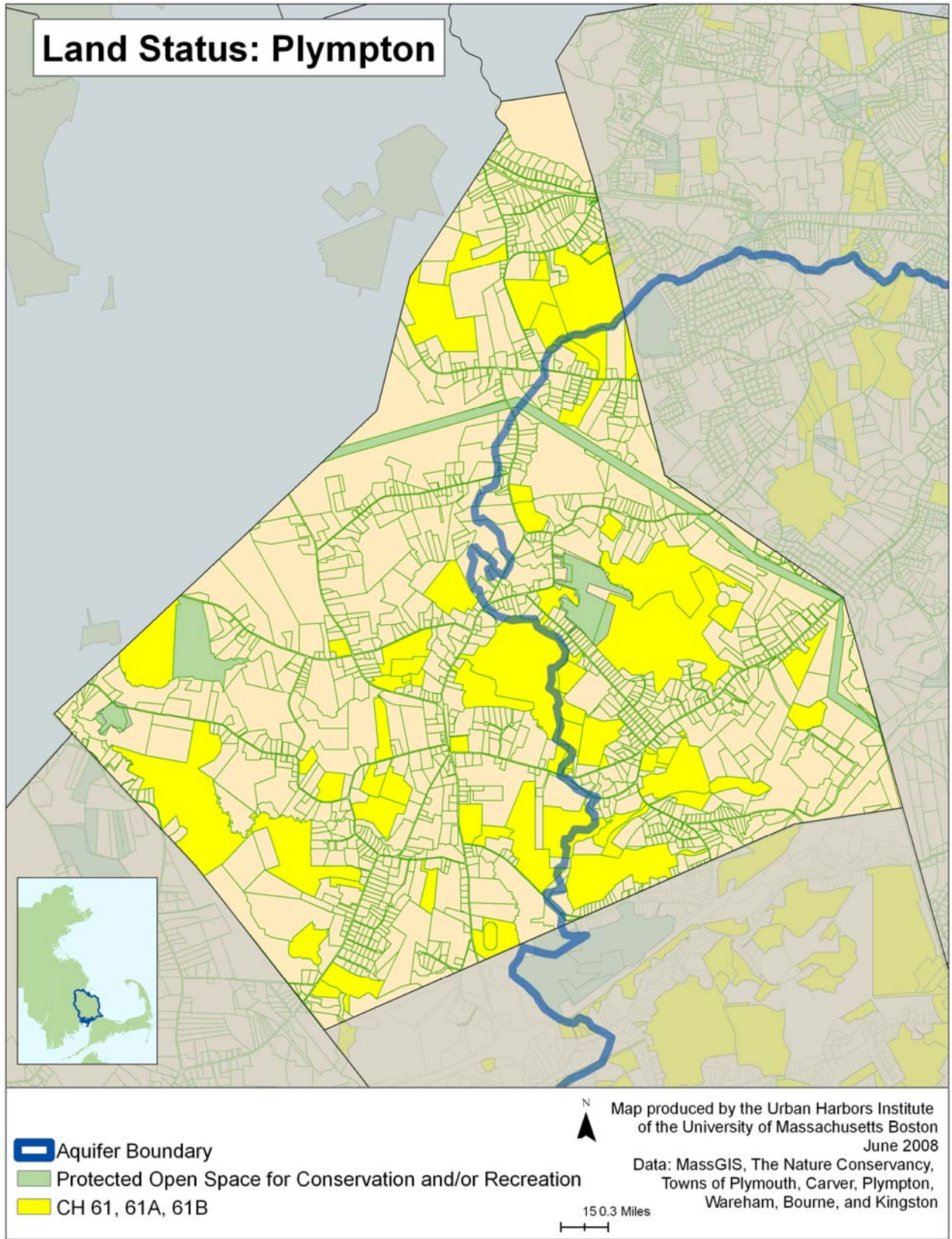
Contamination Considerations in Plympton

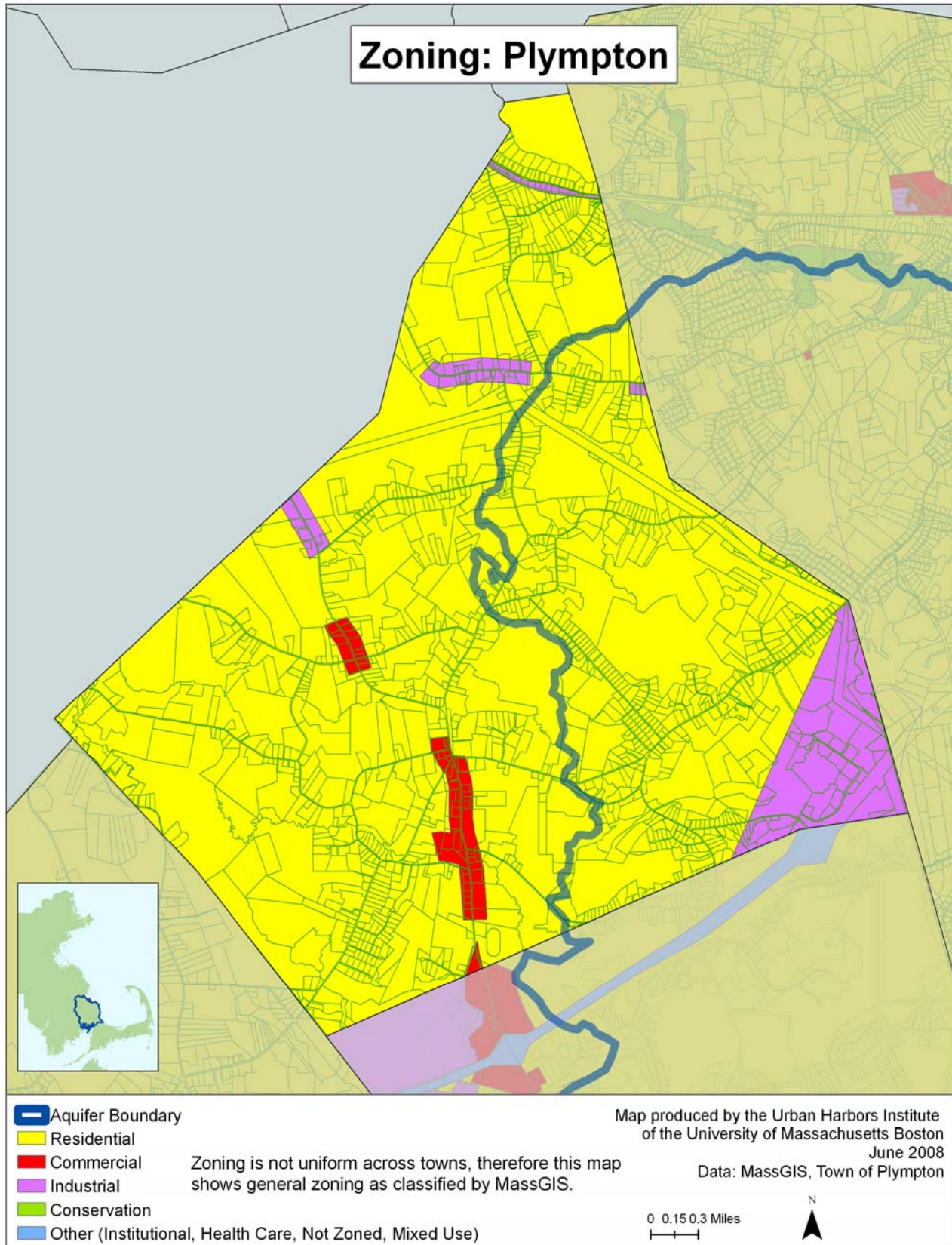




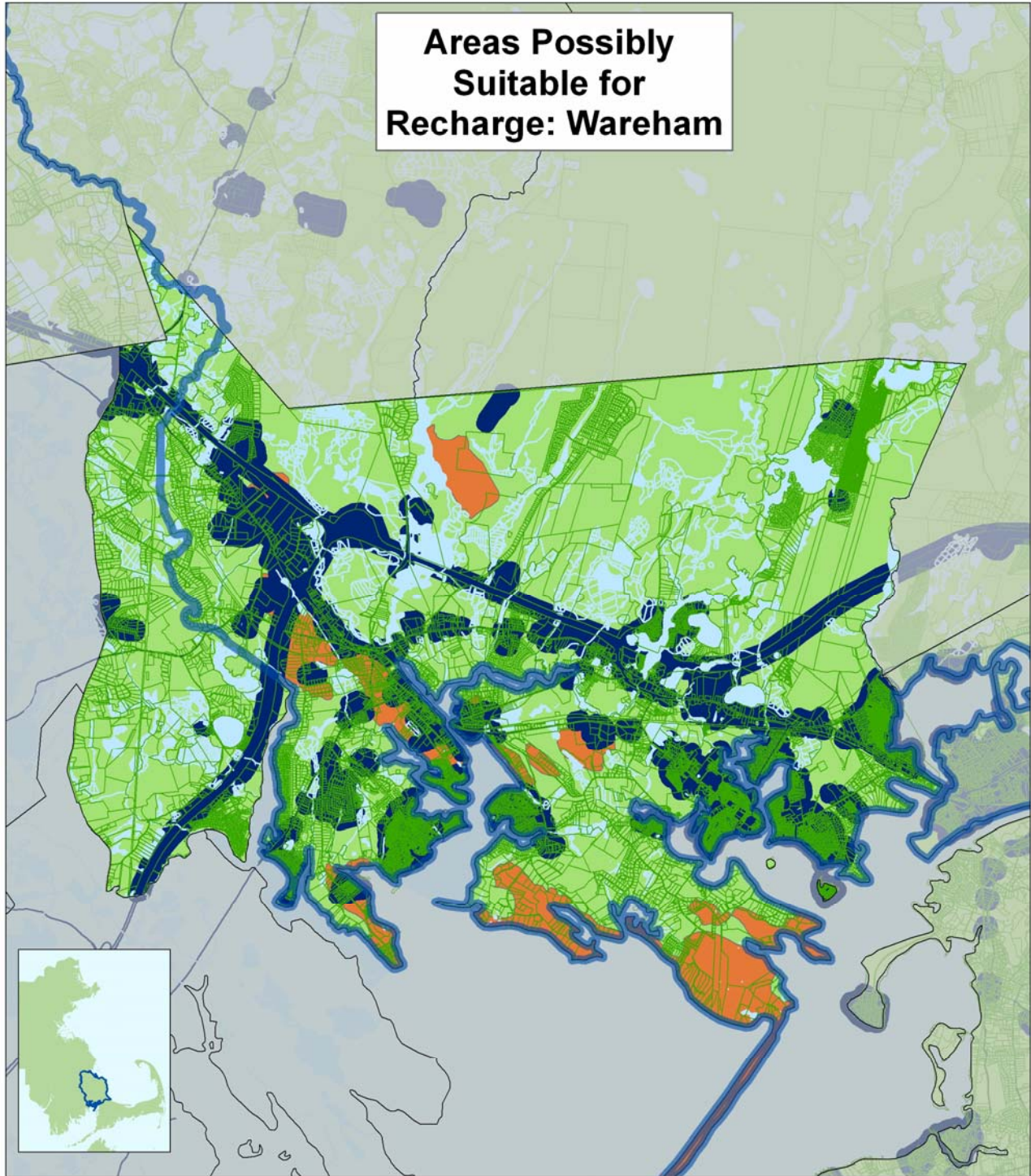
Habitat Considerations: Plympton







Areas Possibly Suitable for Recharge: Wareham



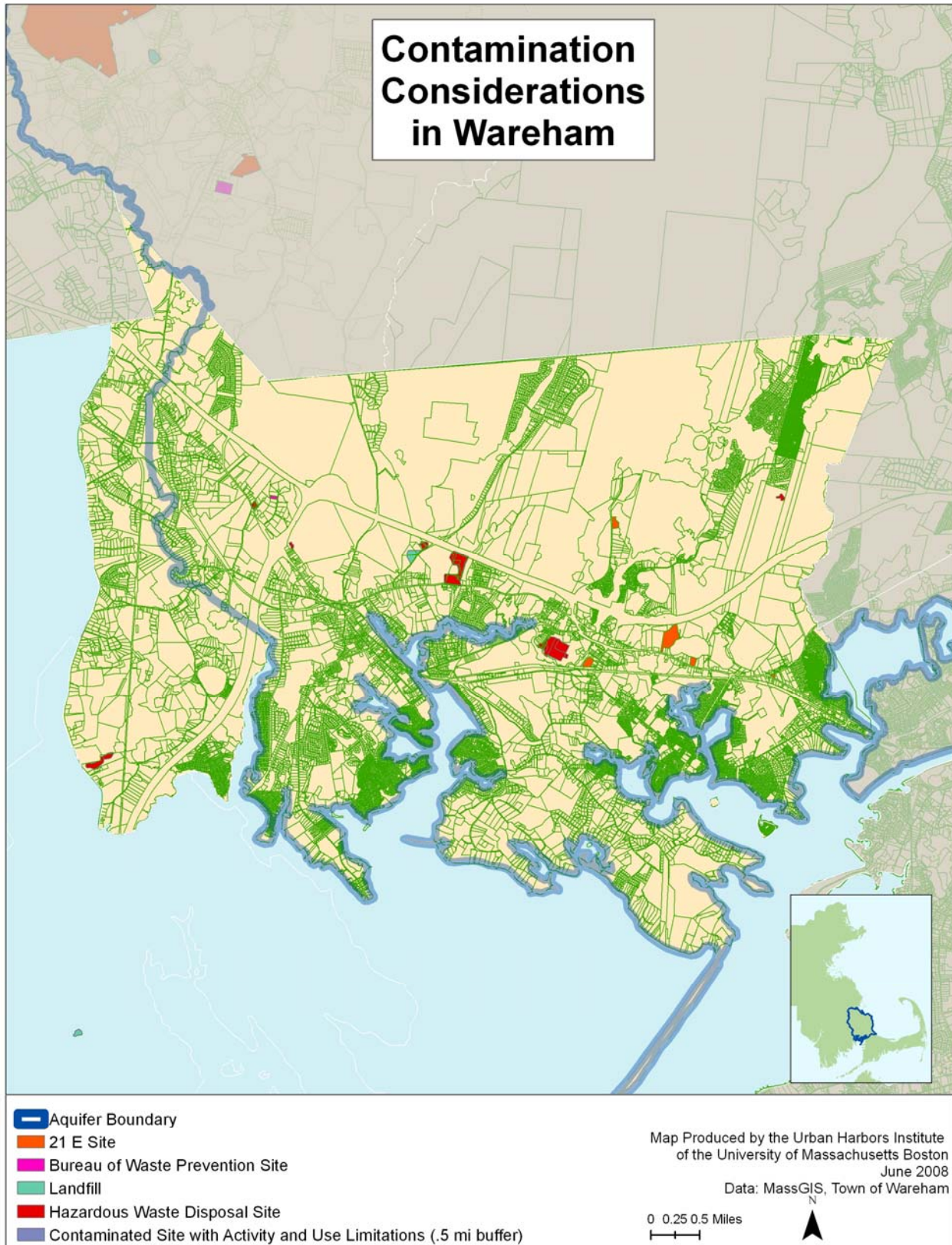
- Aquifer Boundary
- High Impervious Surface (buffered)
- Bedrock and End Moraine
- Discharge Area
- Possible Recharge Areas

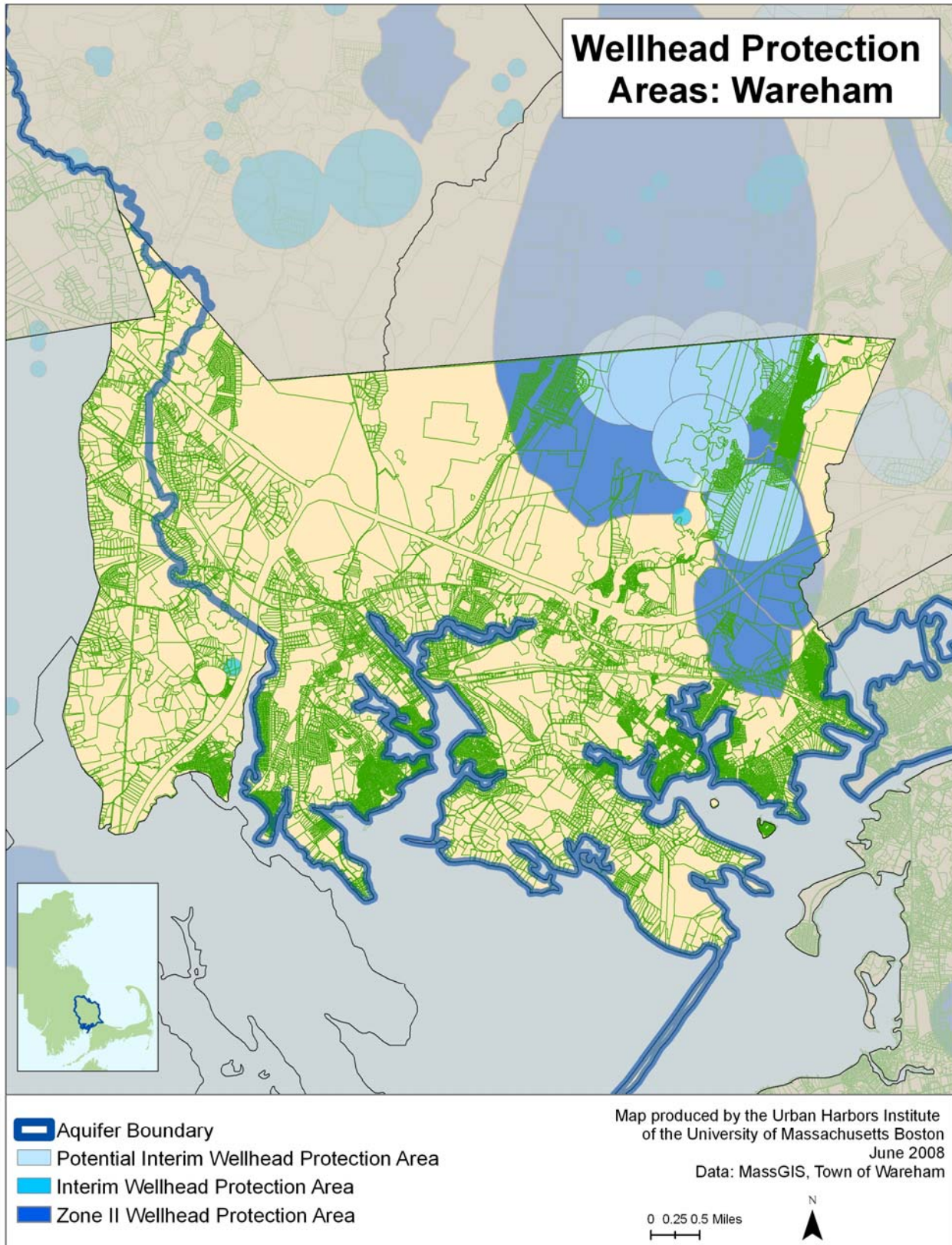
Map note: Discharge areas include streams, ditches, canals, wetlands, marshes, swamps, bogs, lakes, ponds, rivers, and impoundments

Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS, Town of Wareham

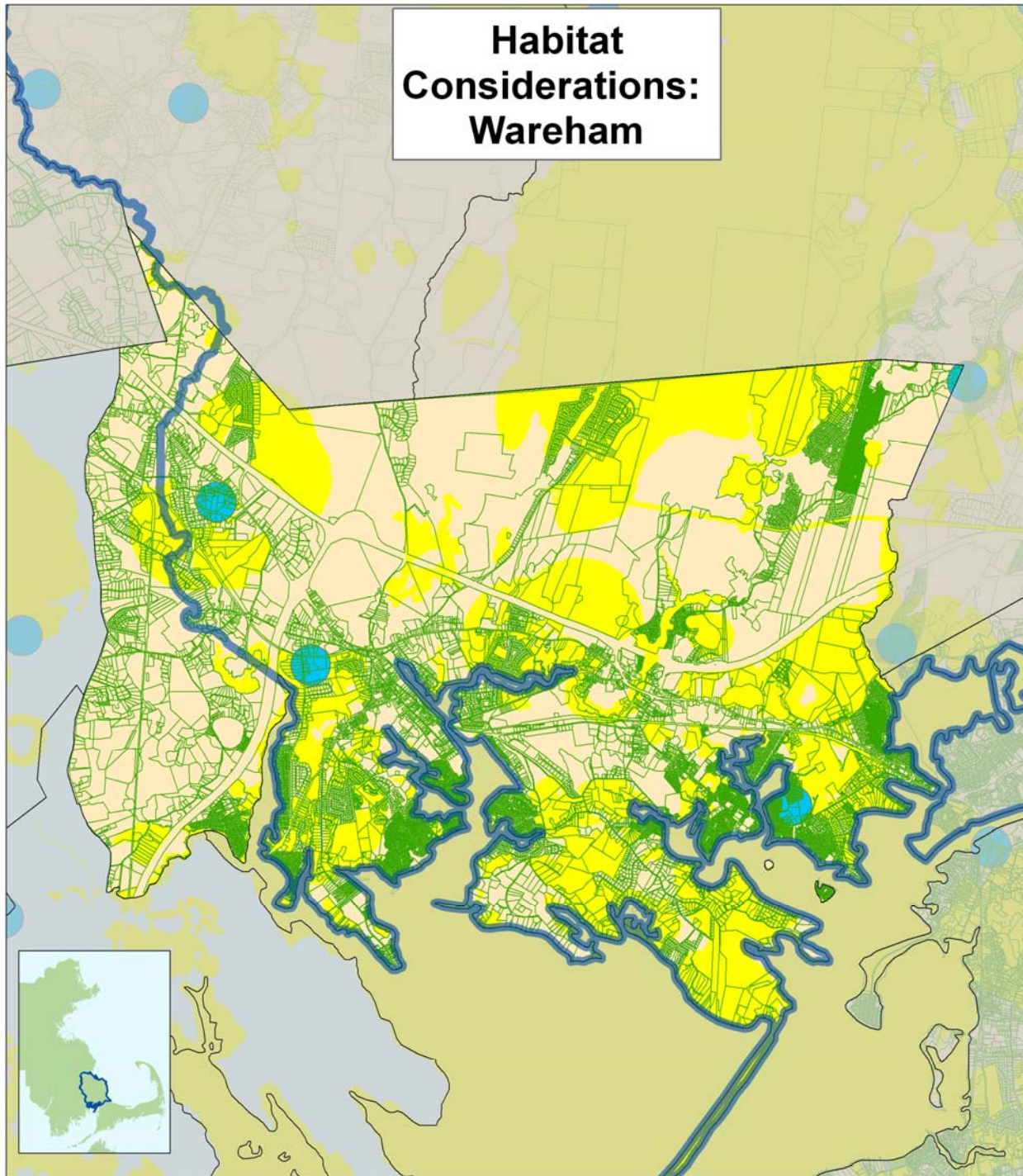
0 0.25 0.5 Miles
—|—|—|











Habitat Considerations: Wareham



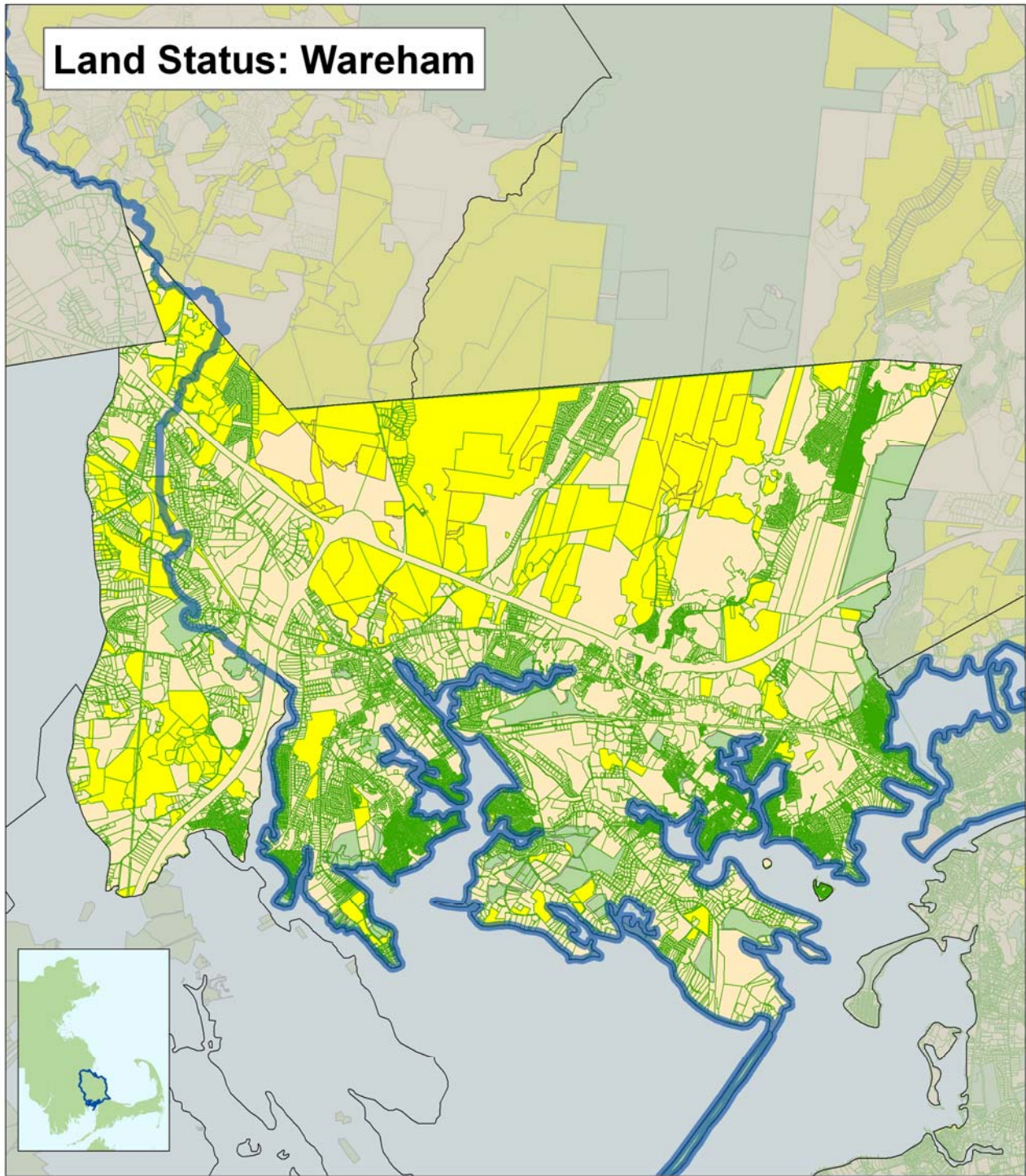
-  Aquifer Boundary
-  Certified Vernal Pools (1000 ft. buffer)
-  Area of Critical Environmental Concern and/or Priority Habitats of Rare Species

Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008
Data: MassGIS, Town of Wareham

0 0.25 0.5 Miles




Land Status: Wareham



 Aquifer Boundary


 Protected Open Space for Conservation and/or Recreation

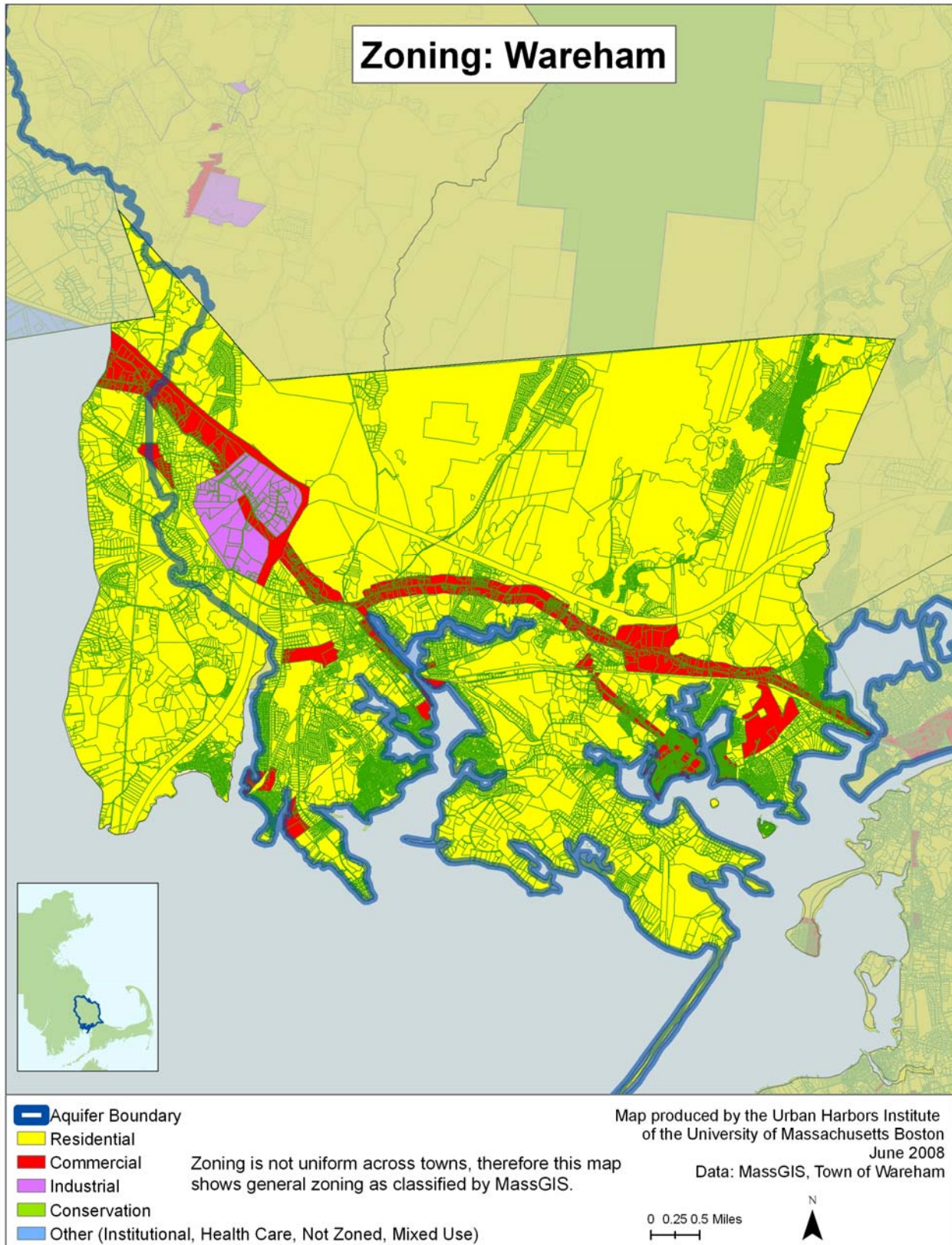
 CH 61, 61A, 61B



Map produced by the Urban Harbors Institute
of the University of Massachusetts Boston
June 2008

Data: MassGIS, The Nature Conservancy,
Towns of Plymouth, Carver, Plympton,
Wareham, Bourne, and Kingston

25 0.5 Miles




FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Maintains or creates low % impervious surface	5								
Lowers or maintains low level of contamination	5								
Is located near existing or potential wellhead or in a particularly important recharge area	4								
Serves large number of people	3								
Crosses municipal boundaries	2								
TOTAL	N/A	N/A							

FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Protects/provides/restores habitat of rare, threatened, or endangered species	5								
Protects/enhances unique habitat such as vernal pools	5								
Secures large and/or well located parcel with habitat value	3								
Protects/restores habitat supportive of diverse species	3								
TOTAL	N/A	N/A							
FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Provides new recreational opportunity									
Improves existing recreational opportunity									
Links recreational opportunities									
TOTAL	N/A	N/A							

FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Preserves historic resource									
Enhances historic resource									
TOTAL	N/A	N/A							
FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Maintains/improves health of residents									
Maintains/improves/creates educational resource									
Maintains/improves/creates social resource									
Maintains/improves fiscal stability									
TOTAL	N/A	N/A							

FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Protects/creates unique view									
Protects/creates historic view									
Maintains/improves safety									
Maintains/improves town's character									
TOTAL	N/A	N/A							
FUNCTION/ATTRIBUTES	WEIGHT	VALUE	MAXIMUM POINTS	BASE SCORE	MULTIPLIER	ADJUSTED SCORE	USER PRIORITY WEIGHT	TOTAL SCORE	COMMENTS
Creates new agricultural activity									
Supports or enhances existing agricultural activity									
TOTAL	N/A	N/A							
							FINAL SCORE		

APPENDIX B: Potential Well Sites

The Department of Environmental Protection has developed a list of factors to consider when siting new public wells. Some of the traits listed in Site Screening for Siting a New or Expanding Source of Public Water Supply (DEP 2001) include:

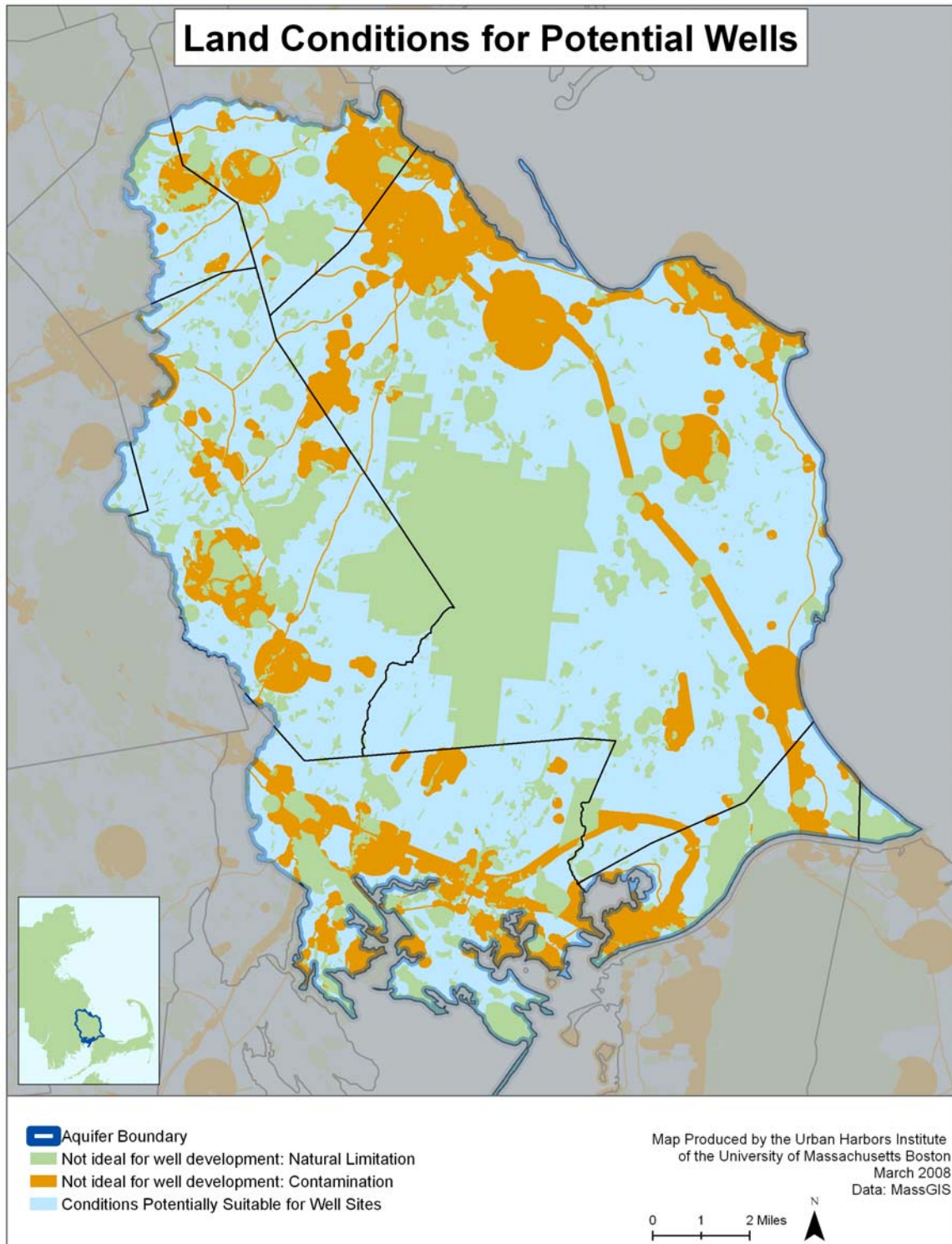
- Areas of Critical Environmental Concern (within 1000 ft. of the site)
- Priority habitat for rare and endangered species (within 1000 ft. of the site)
- Lakes and ponds (or other surface water features) (within 1000 ft. of the site)
- Vernal pools (within 1000 ft. of the site)
- Stocked trout streams (within 1000 ft. of the site)
- Cold water fisheries resource
- NPDES permit sites (National Pollution Discharge Elimination System)
- Hazardous waste sites (within 0.5 miles of the site)
- Wastewater treatment facilities (within 0.5 miles of the site)
- CSOs or SSOs (within 0.5 miles of the site)
- Landfills (within 0.5 miles of the site)
- Agricultural uses (within 0.5 miles of the site)
- Automobile graveyards and junkyards (within 0.5 miles of the site)
- Industrial Park/plant (within 0.5 miles of the site)
- Petroleum and oil bulk stations and terminals (within 0.5 miles of the site)
- Public water withdrawals (within 0.5 miles of the site)
- Private wells (within 0.5 miles of the site)
- Location relevant to streams

The following map identifies some land conditions that are not suitable for well development because of natural limitations or contamination concerns. By default, the remaining land might be considered suitable for siting a well – though not all of the site screening limitations could be mapped, so there may be additional barriers in addition to what is mapped. *It is important to note, also, that this map does not take into consideration the availability of water.* The United States Geological Survey (USGS) is currently developing a report that will include data about the availability of water. This USGS report, along with the following map, can be consulted as an initial planning tool for siting new wells. The data in this map is all available from MassGIS and should be updated as new data becomes available.

Natural limitations mapped: state and federally owned open space, reservoirs, marshes, wetlands, swamps, bogs, lakes, ponds, wide rivers, impoundments, Outstanding Water Resources, certified vernal pools (1000 ft. buffer), bedrock, and end moraines.

Contamination concerns mapped: Landfills (half mile buffer), oil and hazardous material disposal sites (half mile buffer), Bureau of Waste Prevention sites (half mile buffer), 21E sites (half mile

buffer), waste disposal sites (half mile buffer), high impervious surfaces (land over 45% impervious, including multi family, residential lots smaller than ¼ acre, commercial, industrial, and transportation land uses), and other non-potential drinking water source areas (as identified by MassGIS).



APPENDIX C: Receiving Areas

One possible way to protect the aquifer is through a transferrable development rights (TDRs) program. For more detailed information about how TDRs might work, see the bylaw report produced by the Horsley Whitten Group. Simply stated, however, a TDR program can help preserve open space by allowing one landowner to sell the development rights of his/her land (usually an “undeveloped” piece of land – known as the “sending area” - such as a farm or a forest) to another landowner’s property (known as the “receiving area”), thus preventing development in one place, and allowing for more dense development elsewhere.

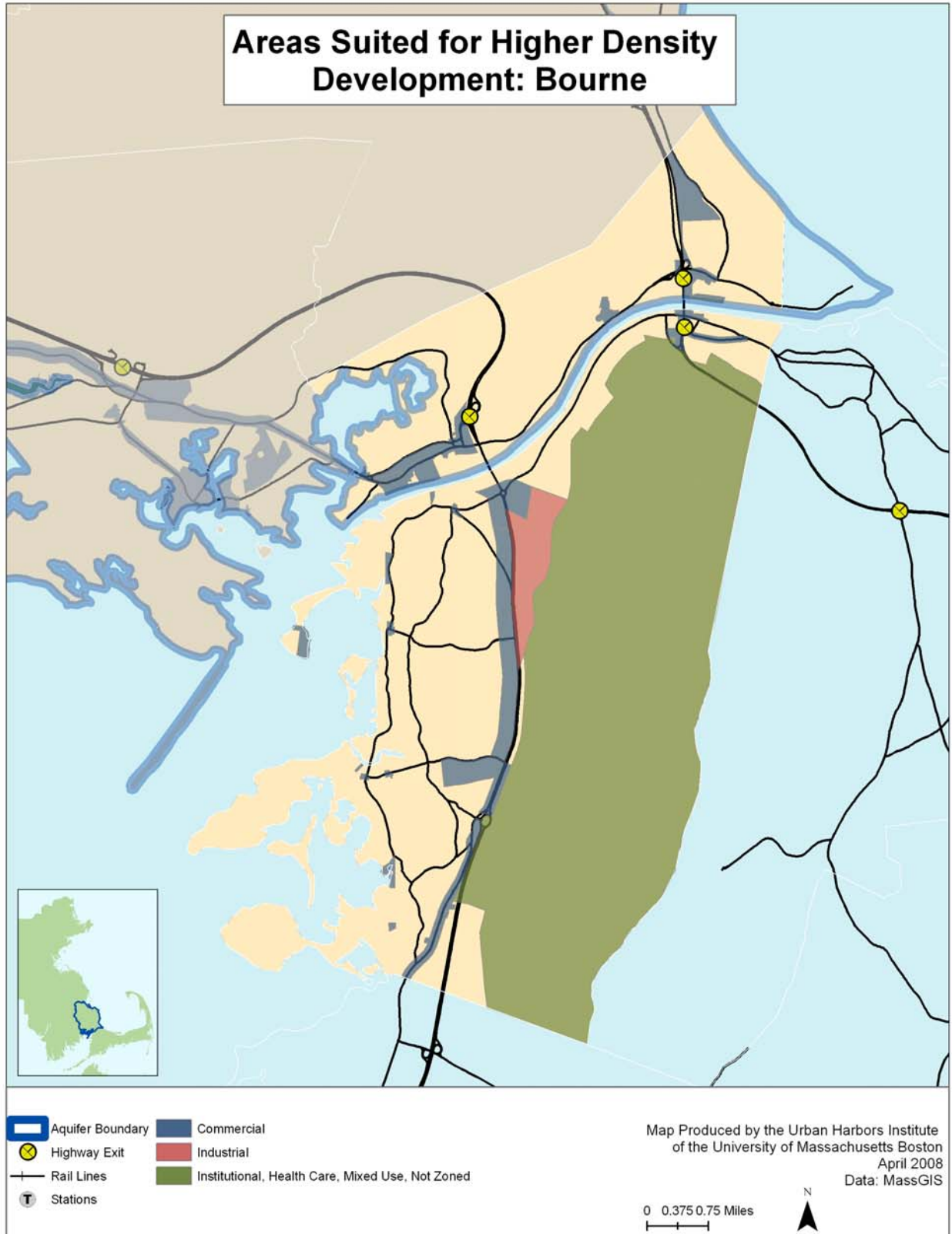
Receiving areas are often located where they can be served by existing infrastructure such as public transportation, highway entrance and exit ramps, public sewers, public water, and other supporting businesses. Towns may have additional factors they wish to consider when identifying areas for higher density development.

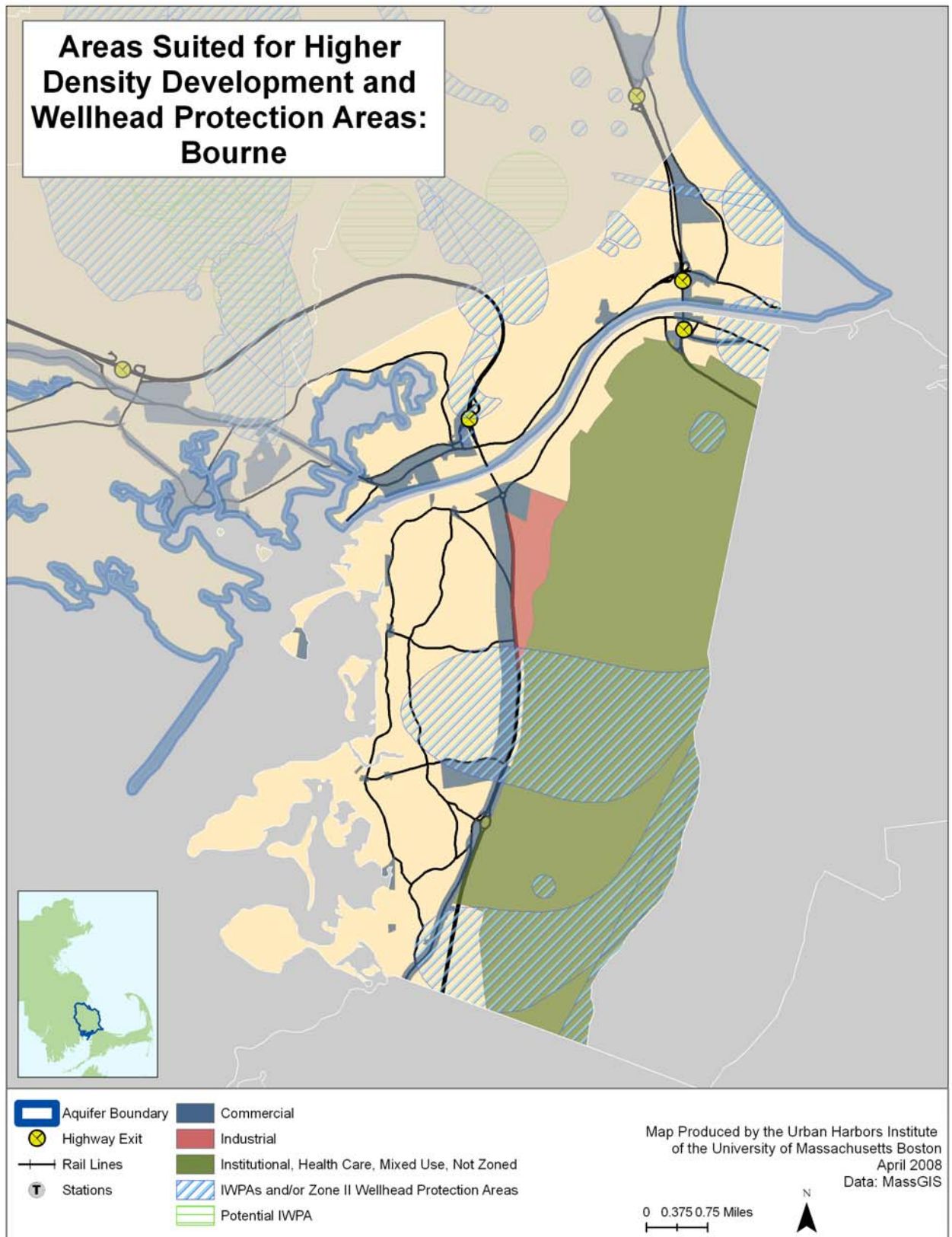
The following series of maps have been produced to help towns think about where they might want to locate receiving areas. Though these maps will help identify areas to focus on, it is important to note that some of the data used to create these maps is not necessarily current, and conditions may have changed since the data was developed. In addition, the zoning areas do not automatically coincide with ideal locations for higher density development given the current uses of the land. It is strongly suggested that these maps only be used as a cursory guide, and that individuals conduct site visits to confirm what is represented on the maps.

There are five maps for each town:

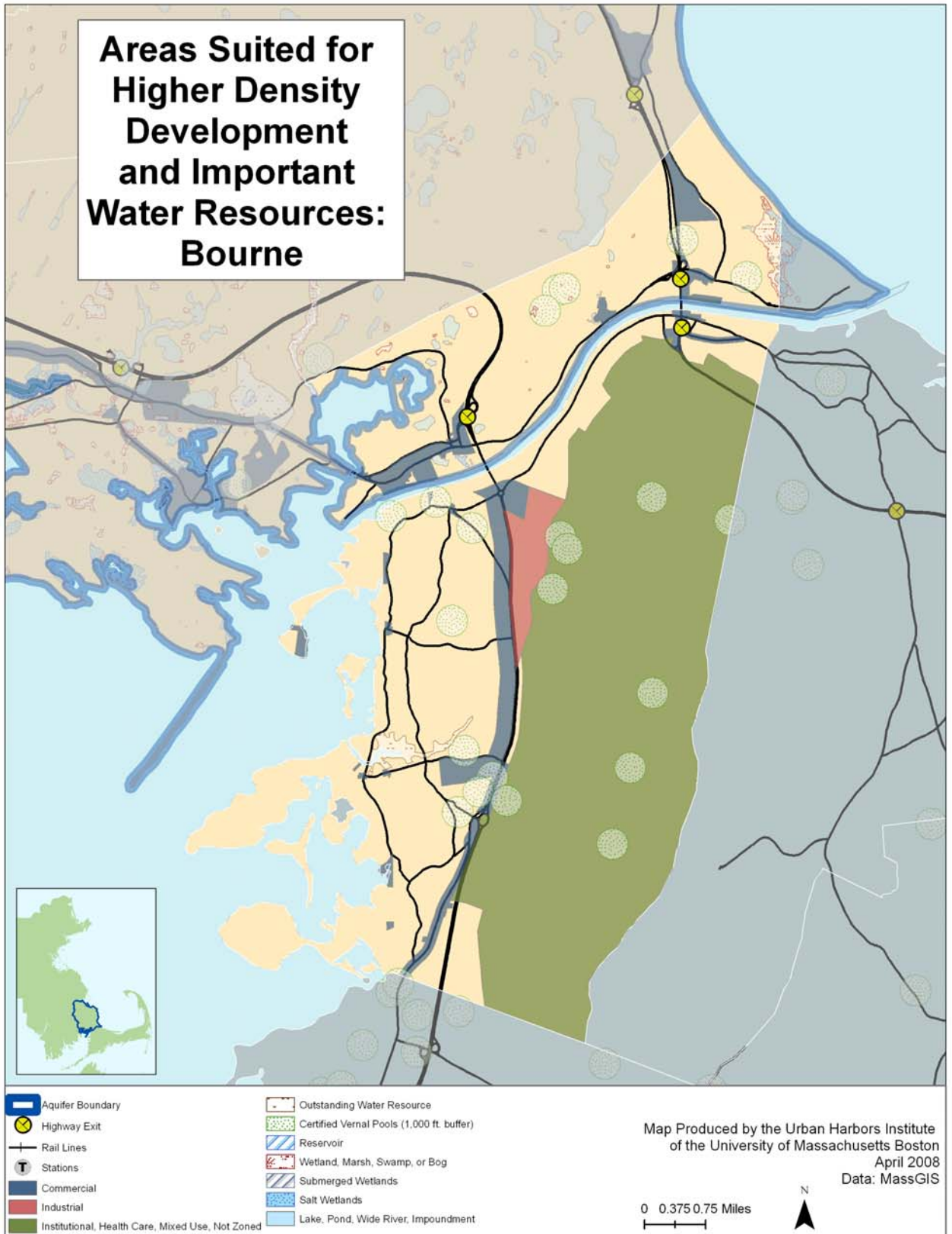
1. The first map (“Areas Suited for Higher Density Development”) shows rail lines, MBTA stations, major roads, highways exits, and zoning that may be conducive to high density development. These maps do not show overlay districts.
2. The second map (“Areas Suited for Higher Density Development and Wellhead Protection Areas”) shows the features of the first map, as well as existing IWPAs and Zone II recharge areas. Where applicable, these maps also show hypothetical IWPAs applied to the identified potential wells.
3. The third map (“Areas Suited for Higher Density Development and Habitat”) shows the features of the first map, as well as important habitat considerations including Estimated and Priority Habitats of Rare Species (identified by the Natural Heritage and Endangered Species Program), barrier beaches, and Areas of Critical Environmental Concern.
4. The forth map (“Areas Suited for Higher Density Development and Important Water Resources”) shows the features of the first map as well as reservoirs, wetlands, marshes, swamps, bogs, lakes, ponds, rivers, impoundments, and certified vernal pools (with a 1,000 ft. buffer).
5. The final map (“Areas Suited for Higher Density Development and Land Status”) shows all of the features of the first map, as well as CH 61, 61A, and 61B land, state and federal protected open space, existing protected open space (if available), and land identified as important (for acquisition or future use) in the open space and recreation plans.

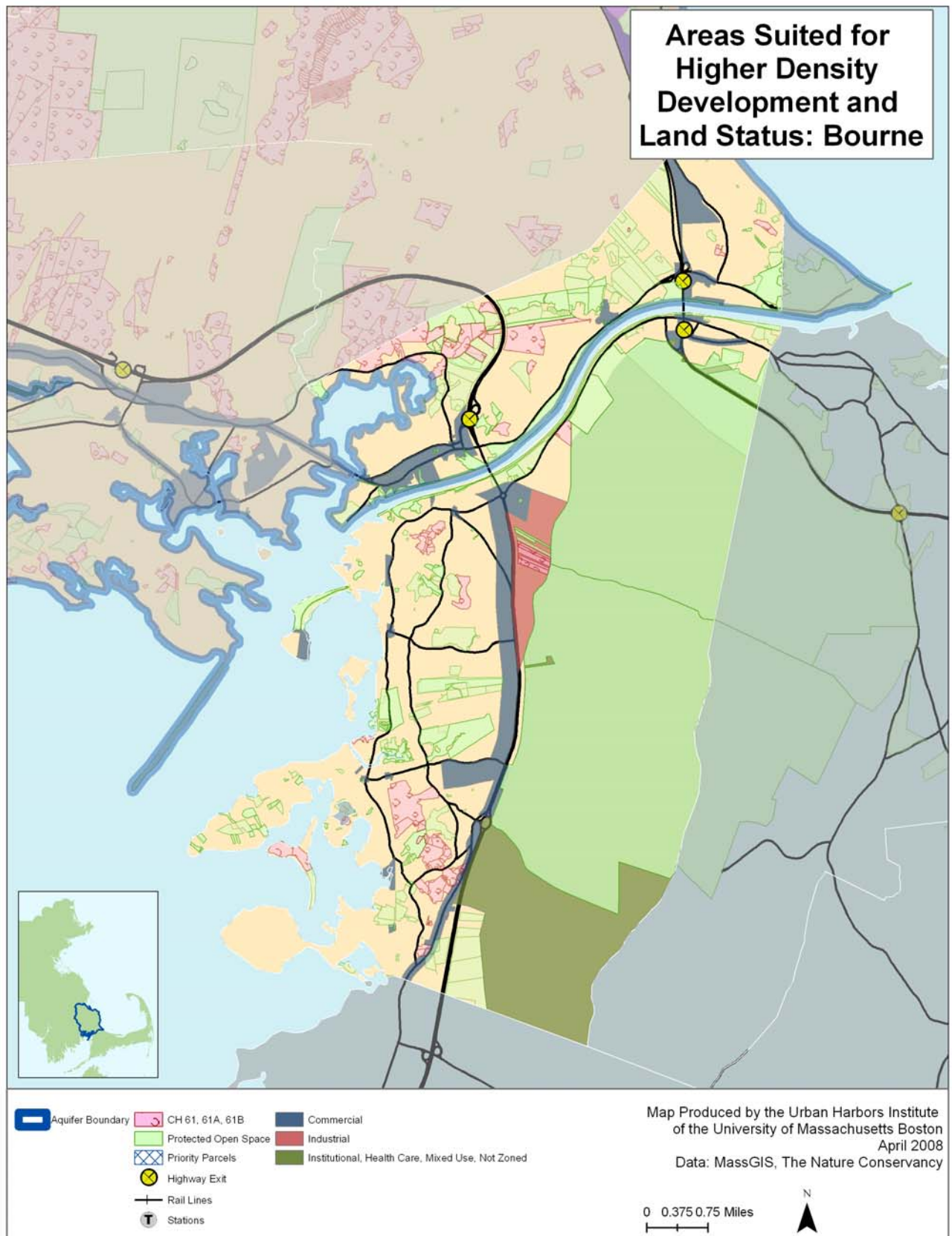
Areas Suited for Higher Density Development: Bourne

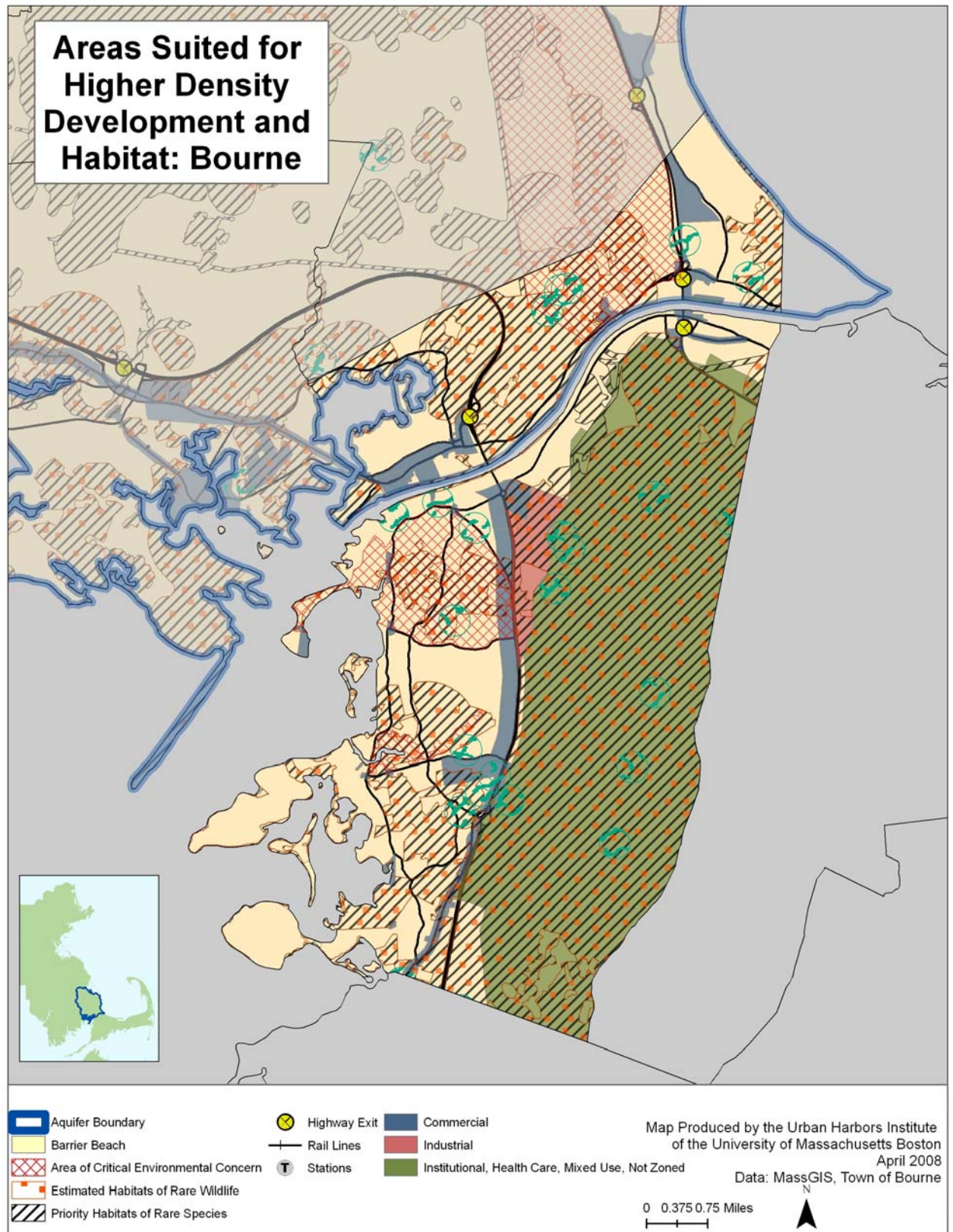


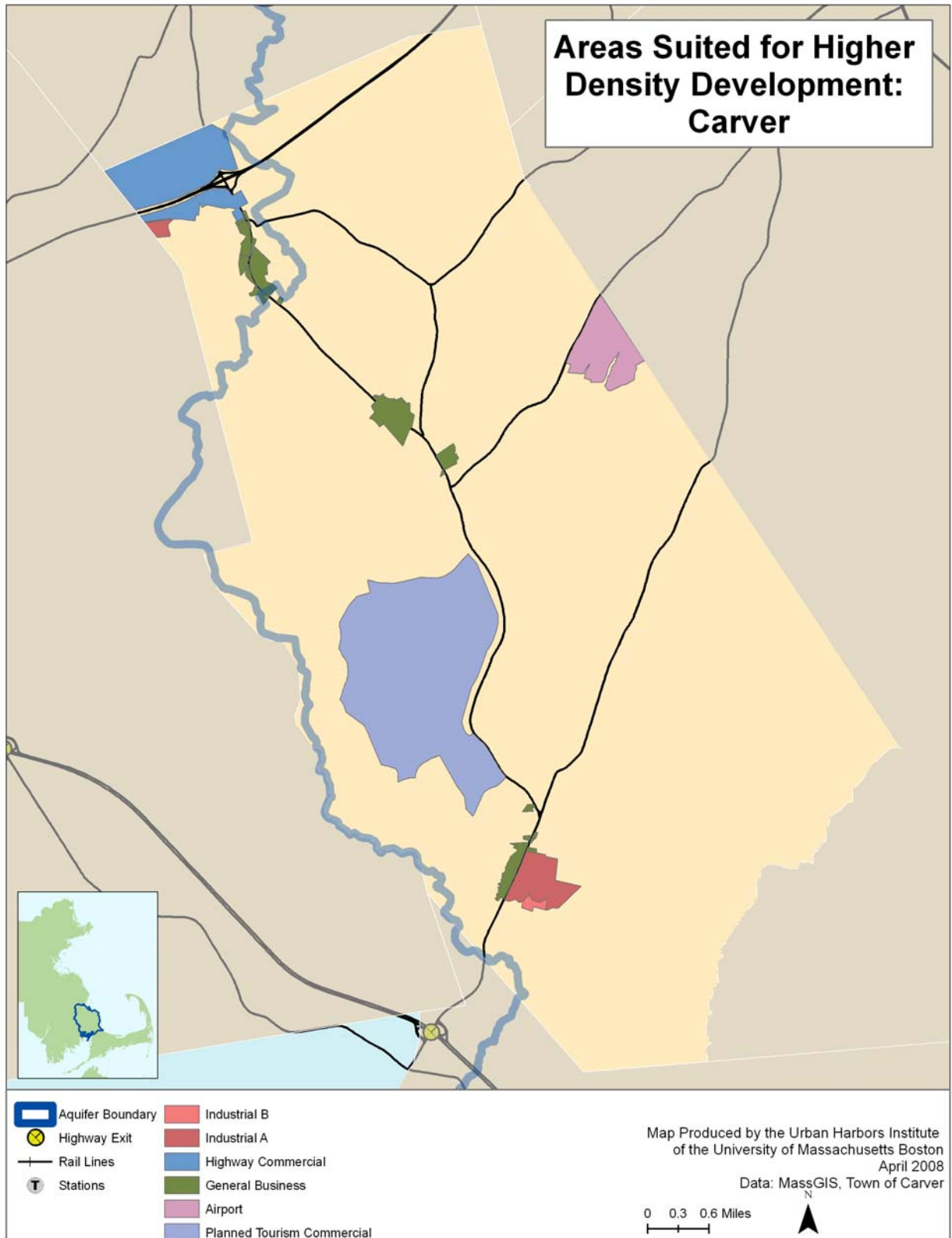


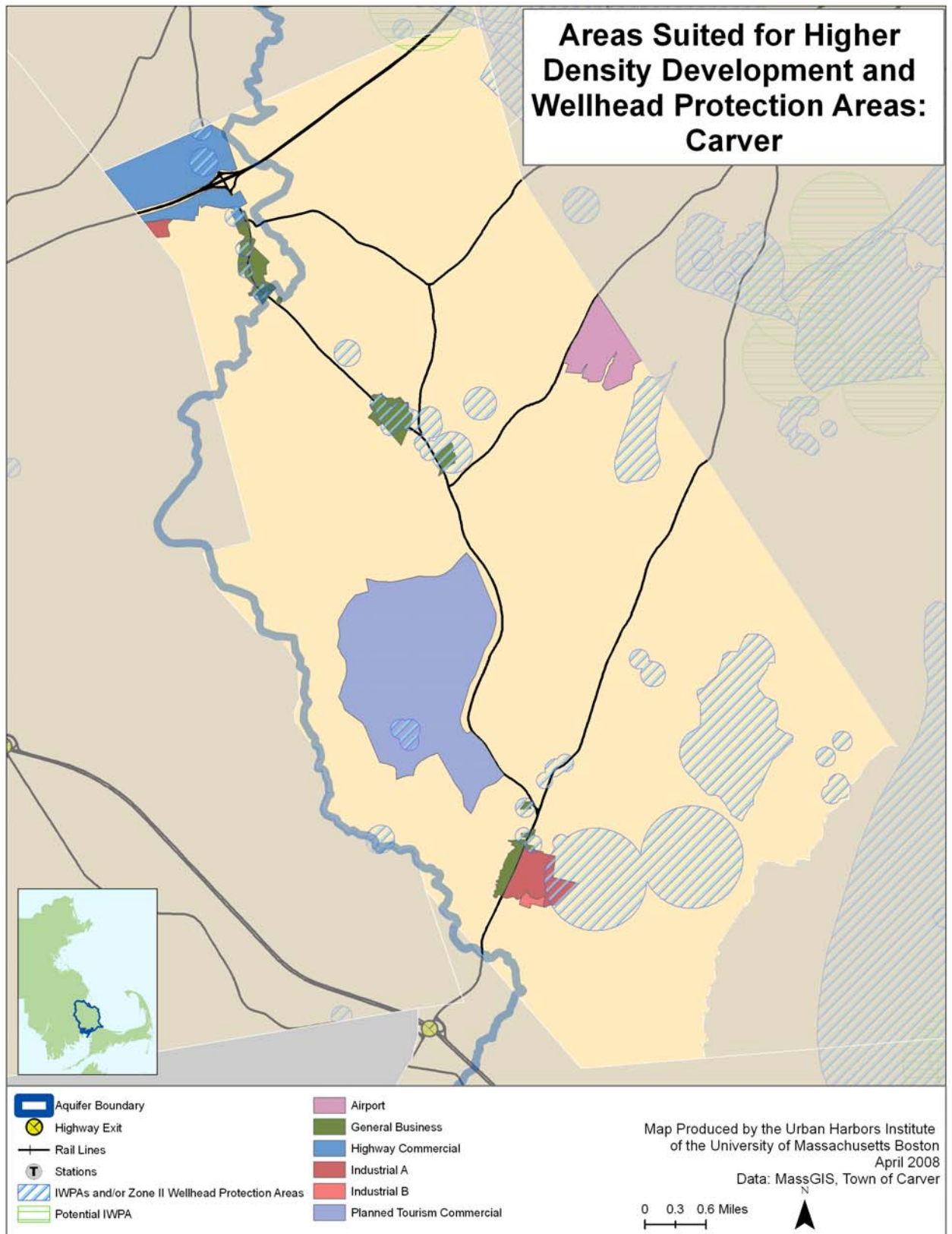
Areas Suited for Higher Density Development and Important Water Resources: Bourne

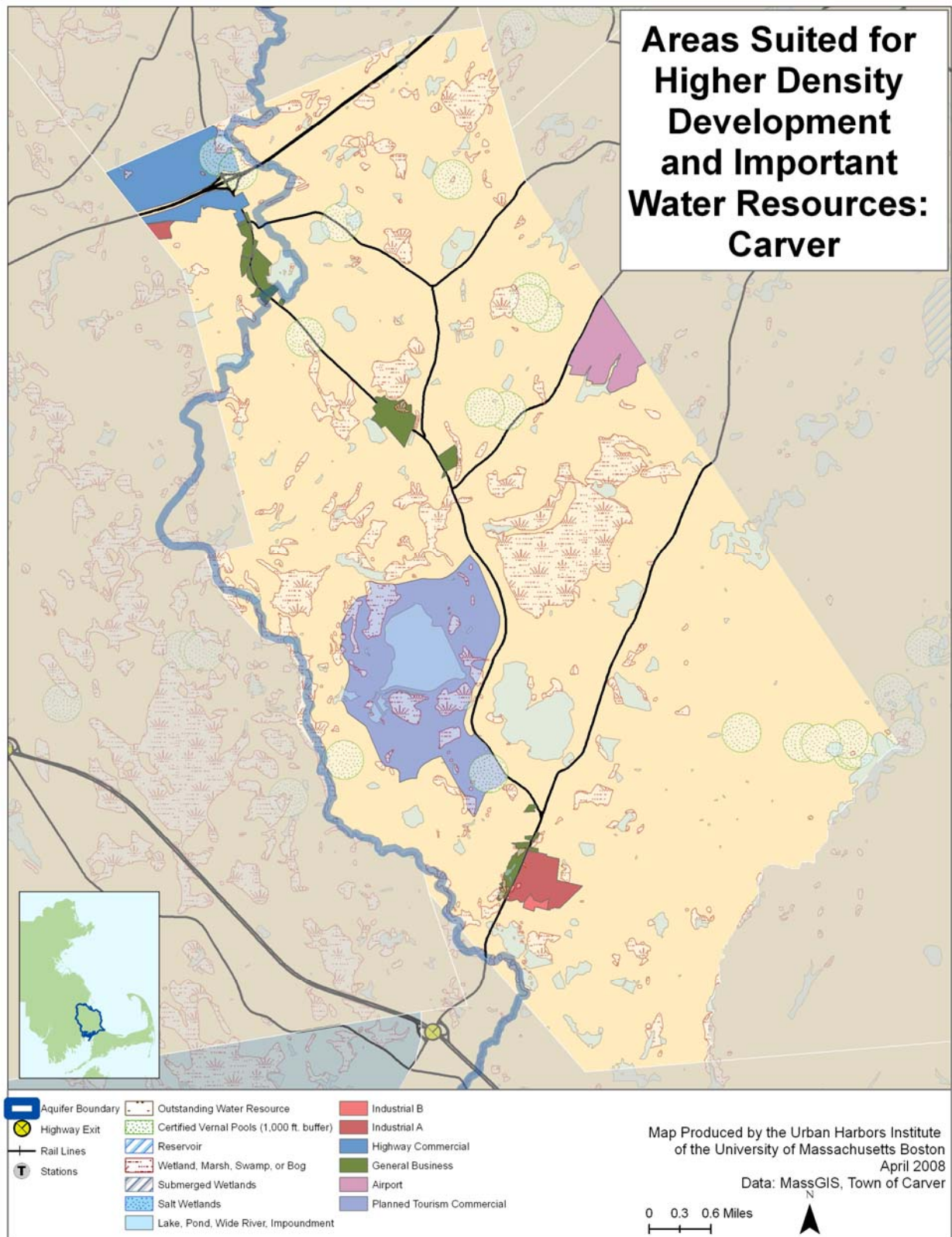


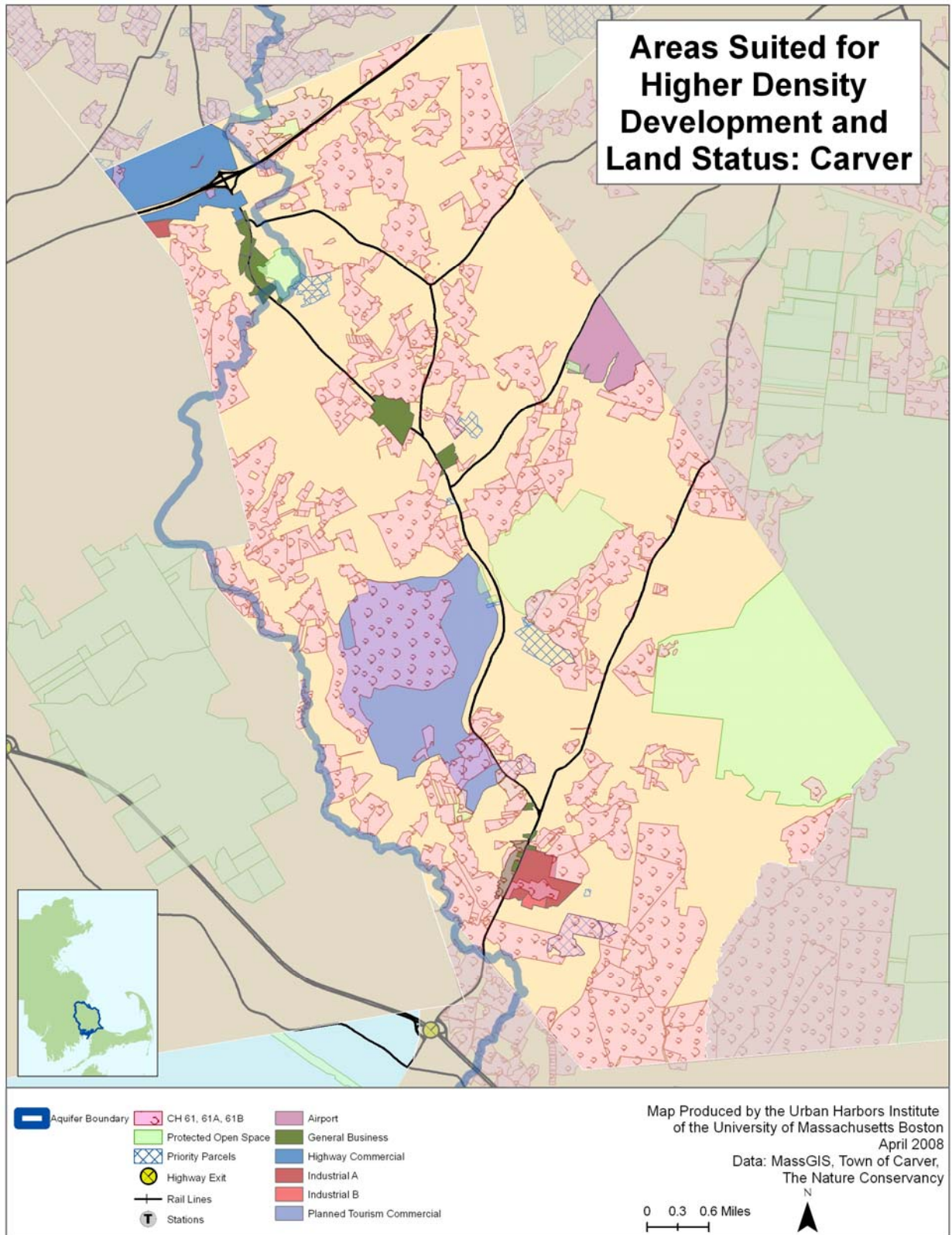


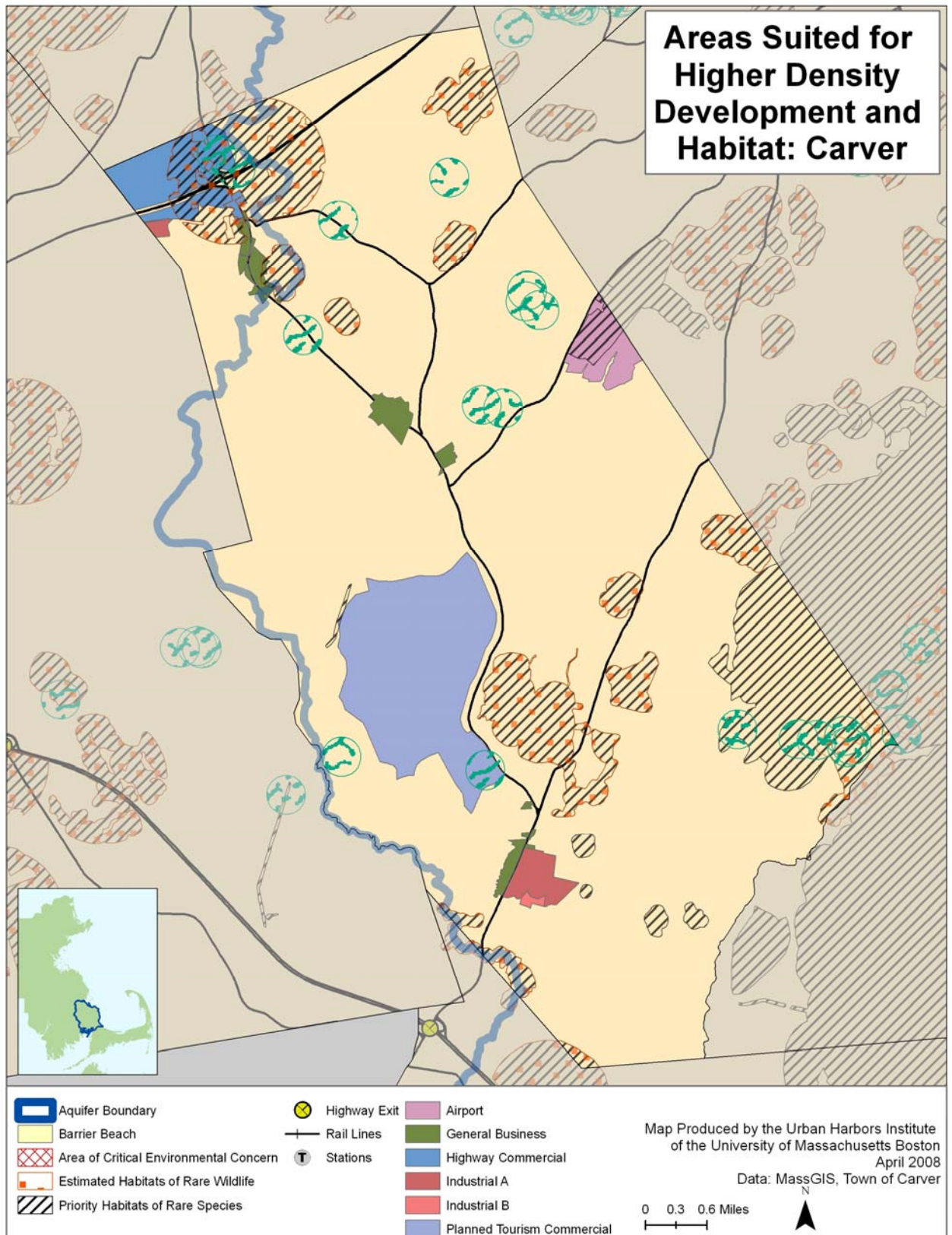


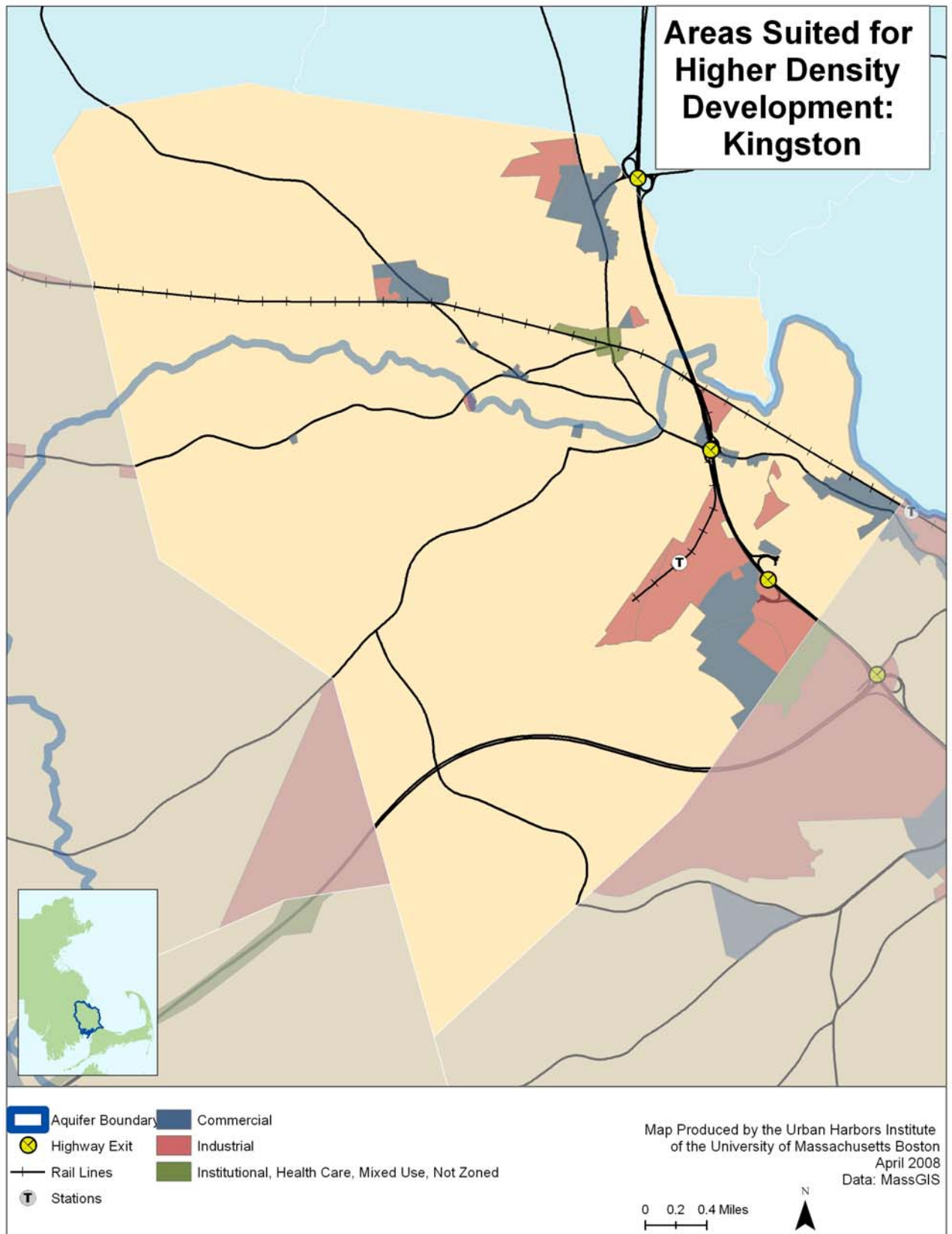


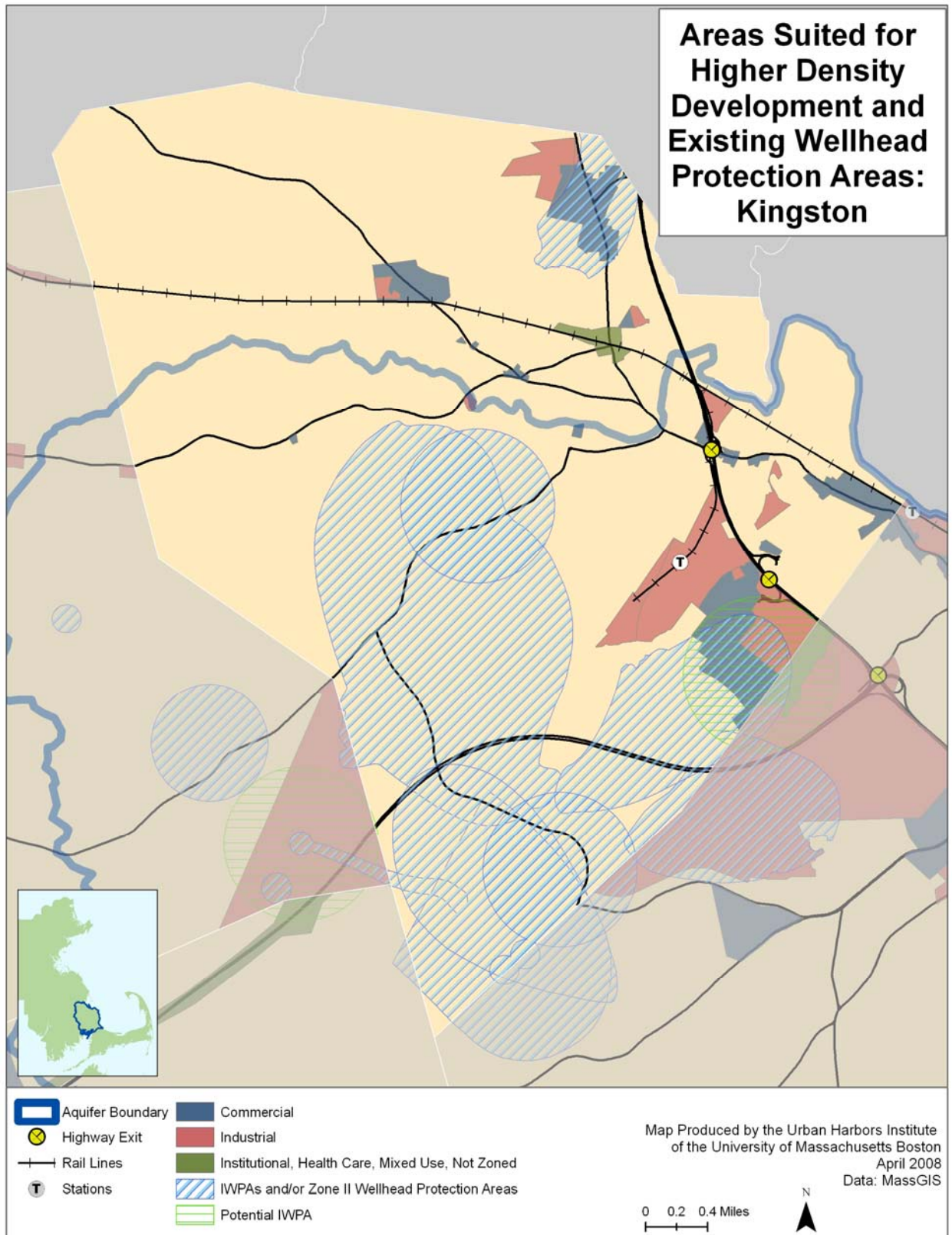


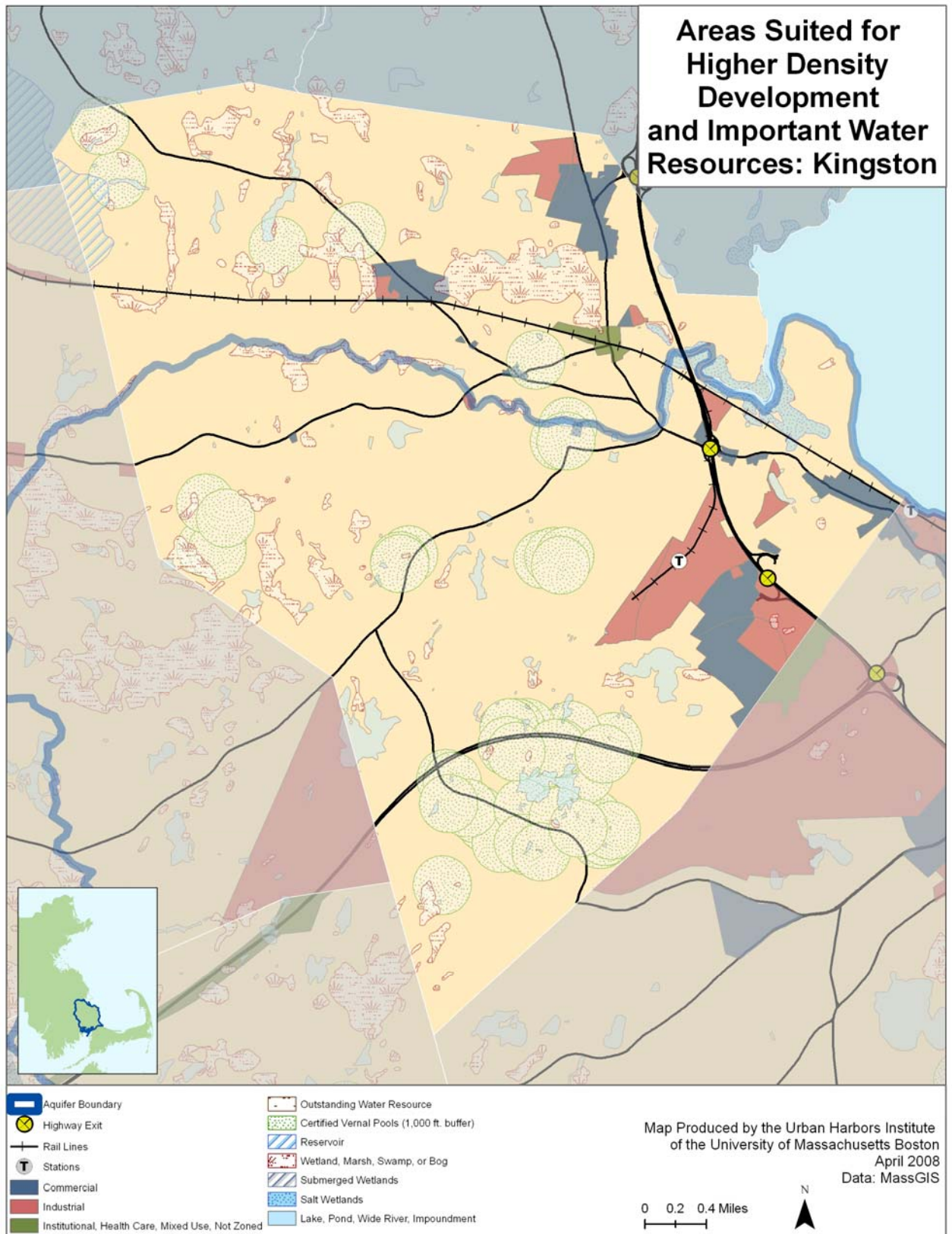


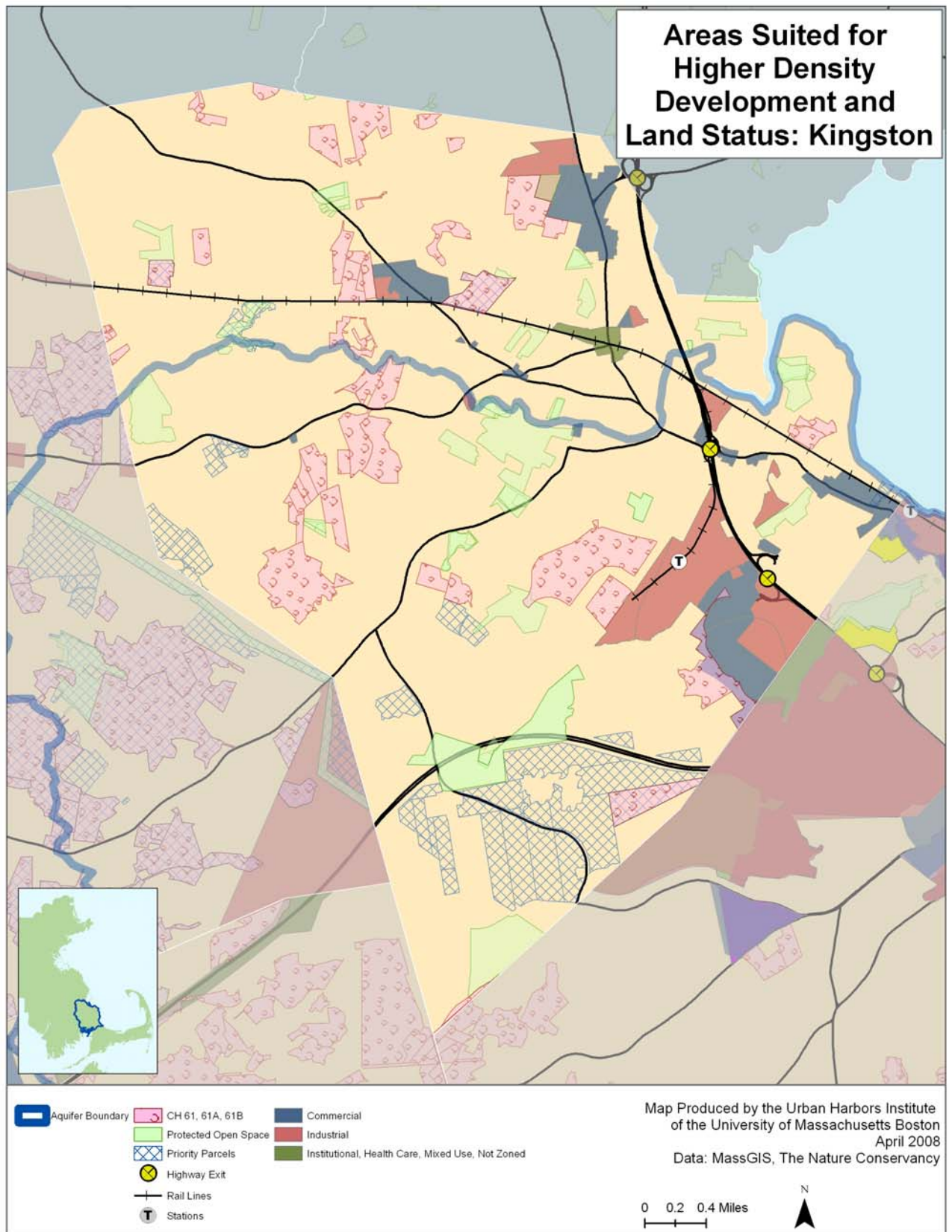


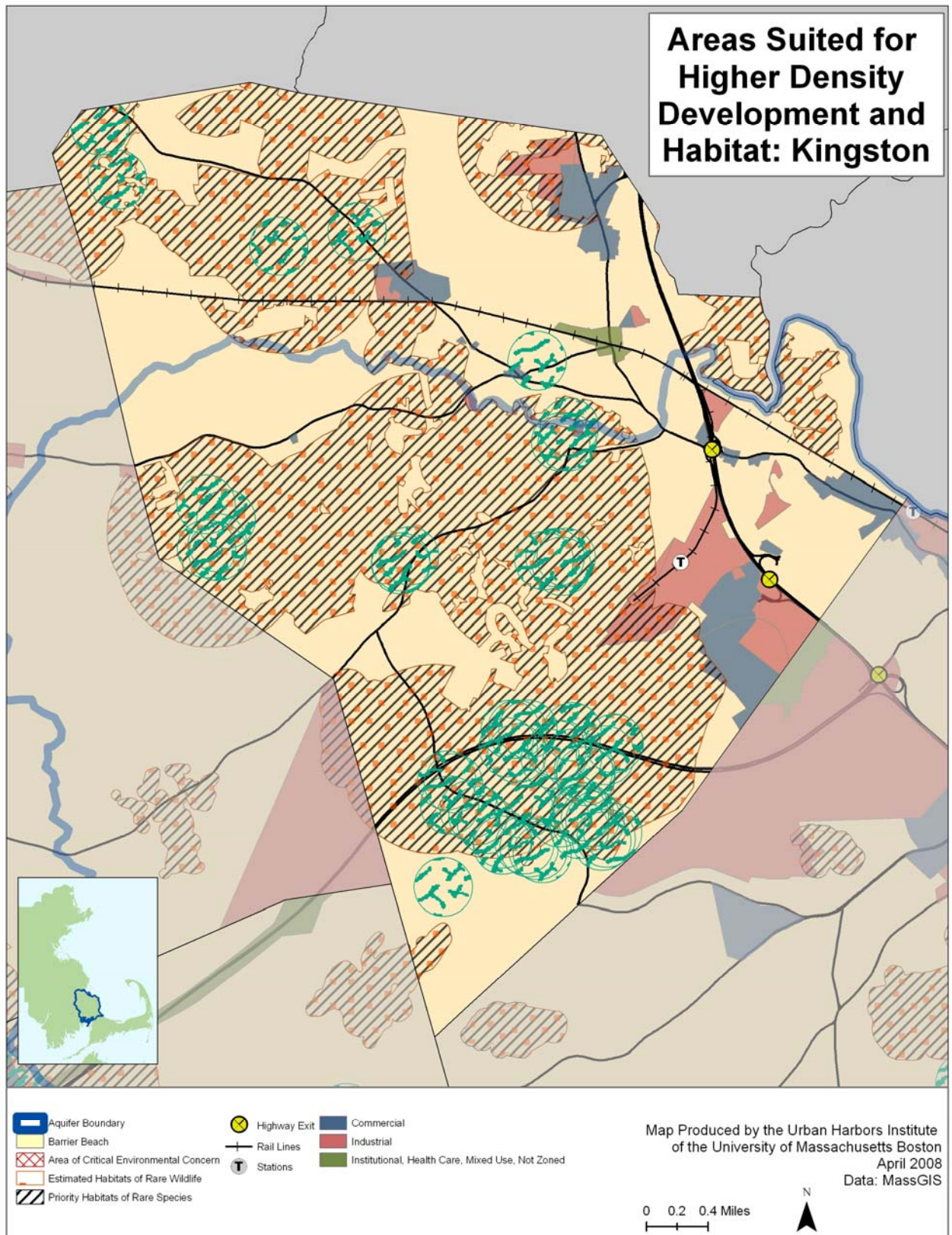




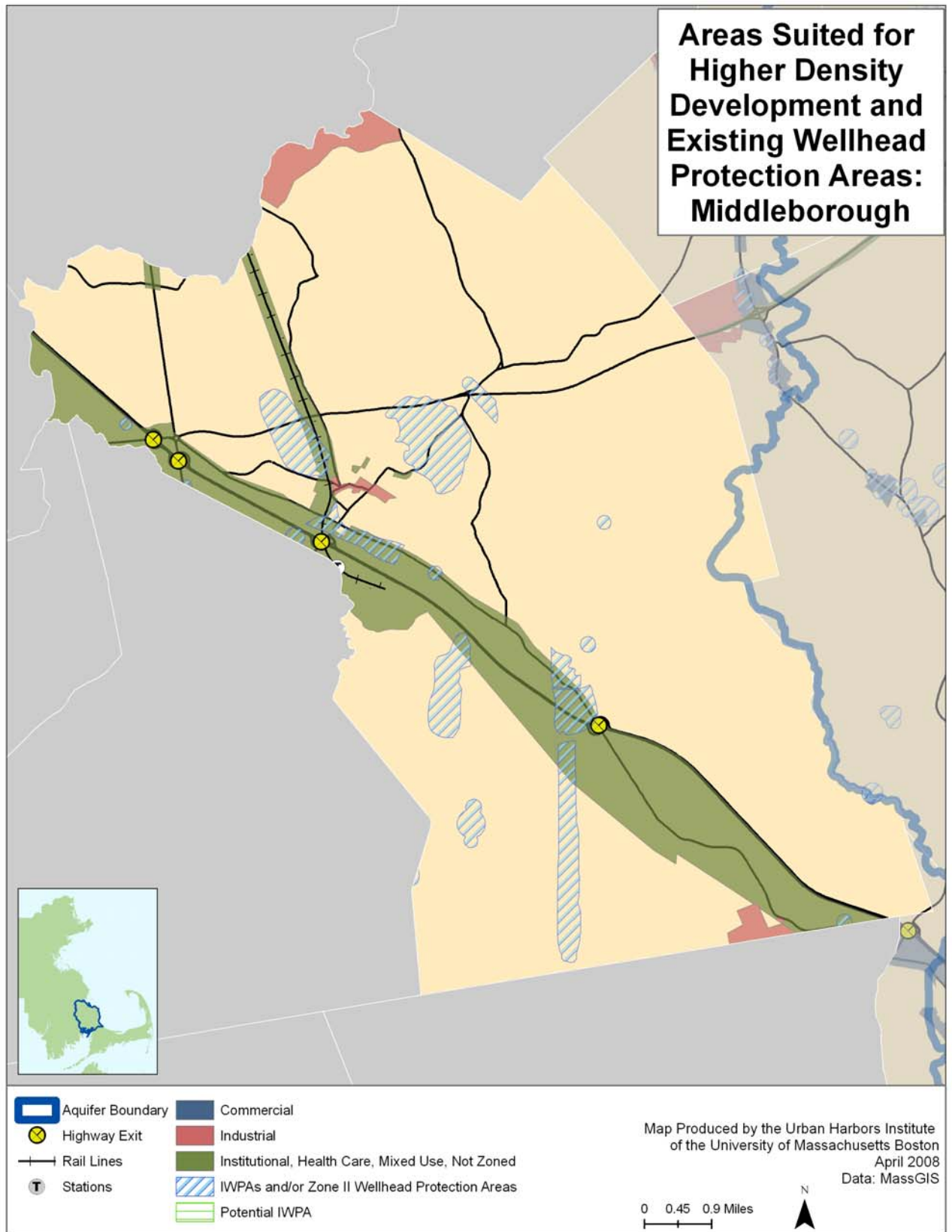




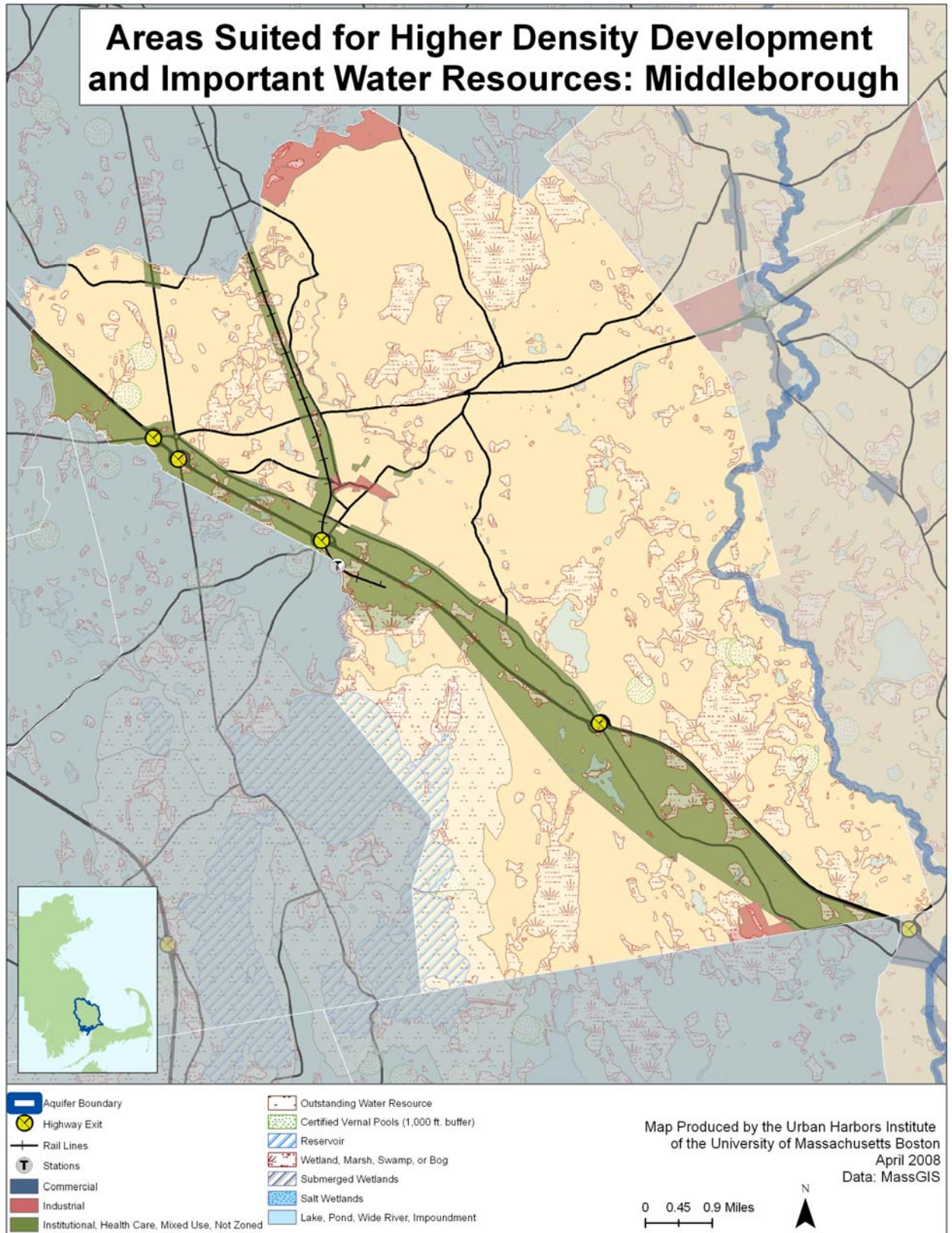


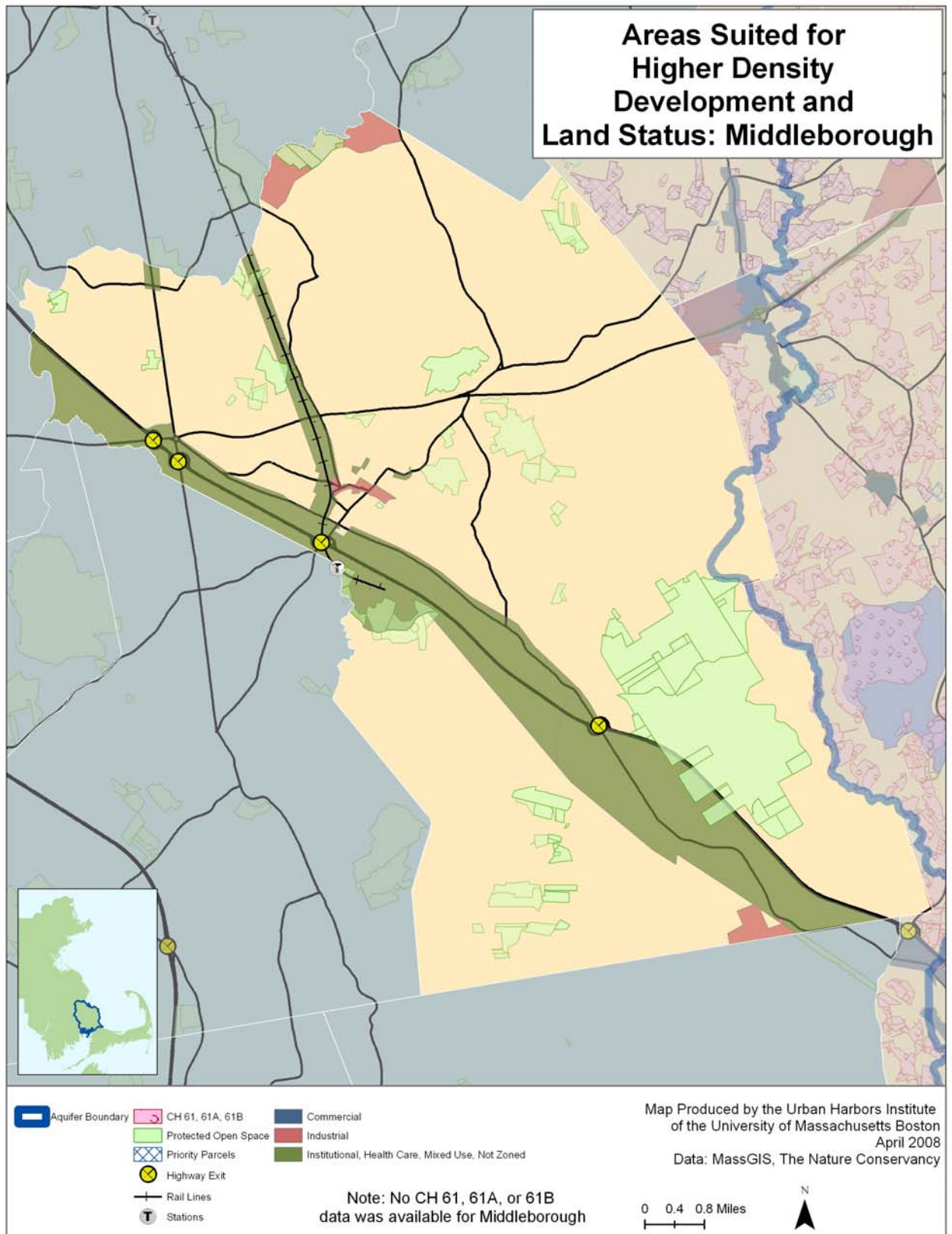




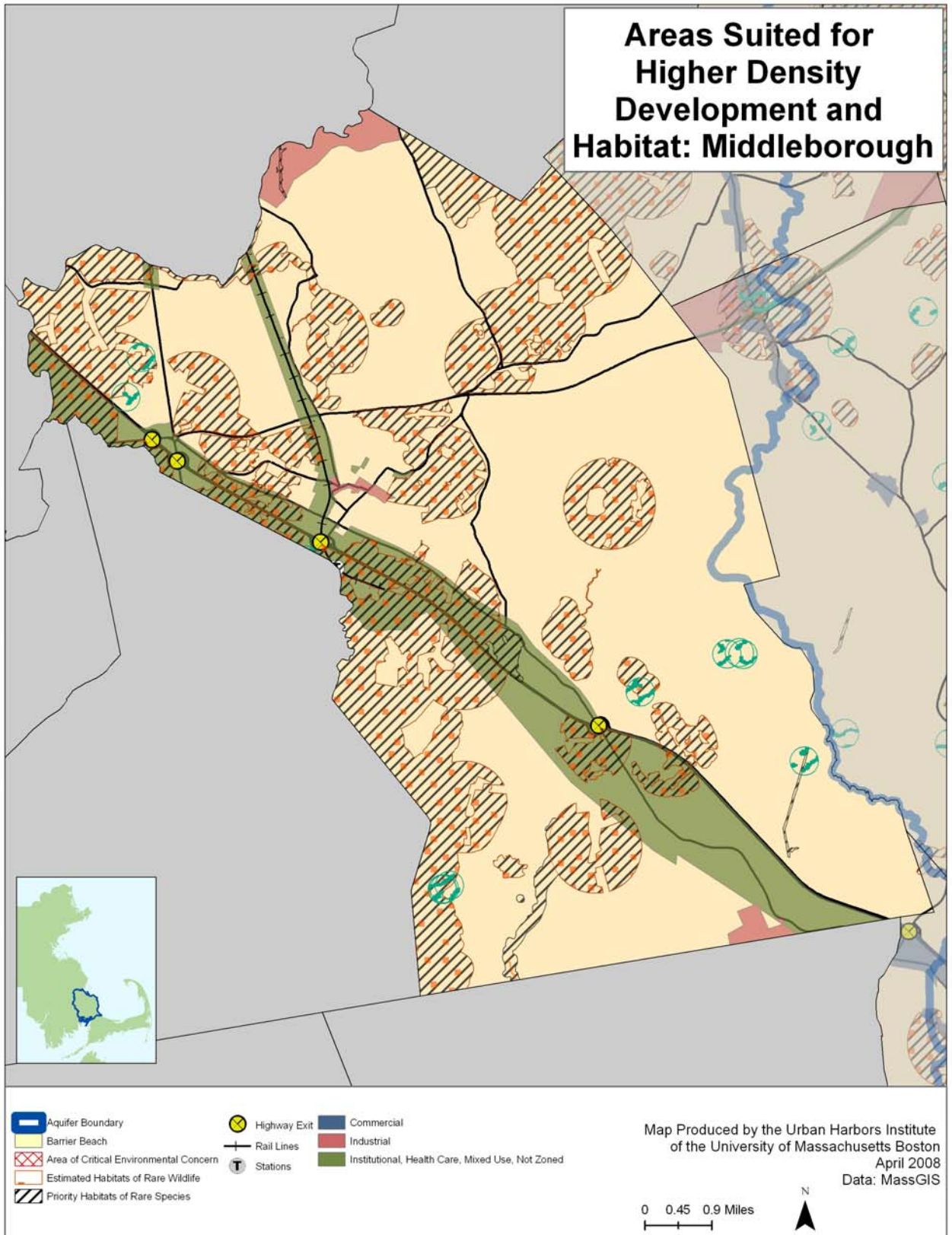


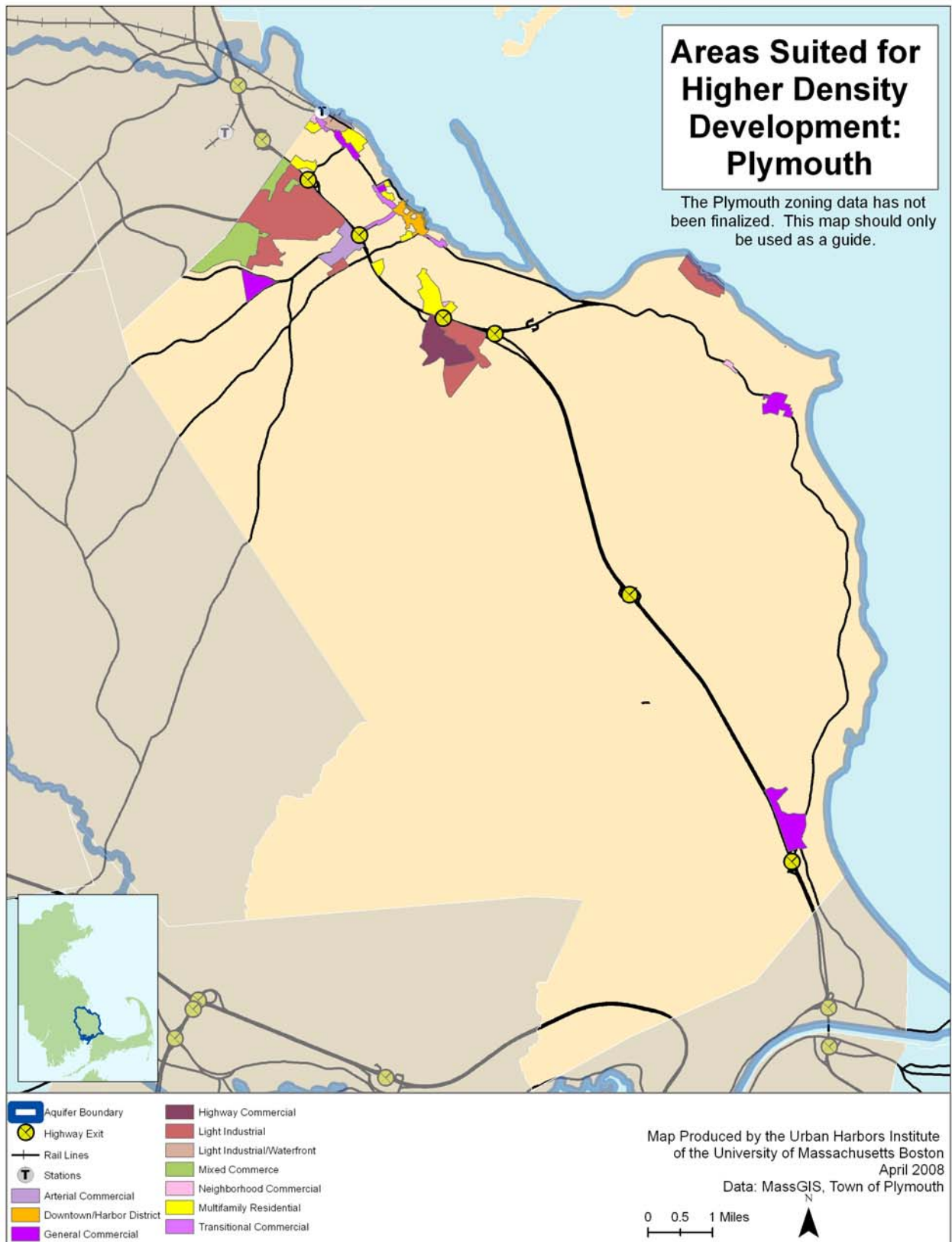
Areas Suited for Higher Density Development and Important Water Resources: Middleborough





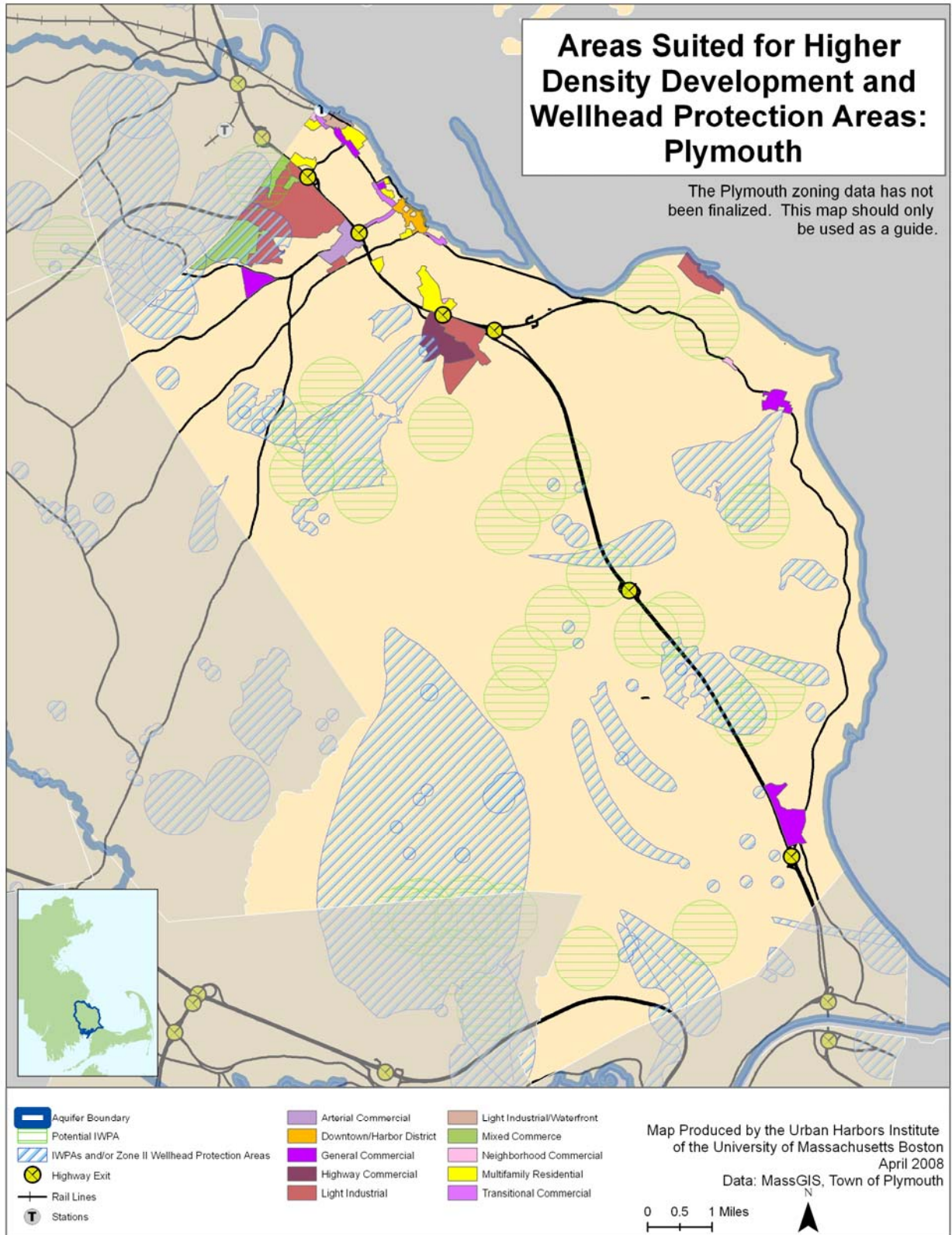
Areas Suited for Higher Density Development and Habitat: Middleborough





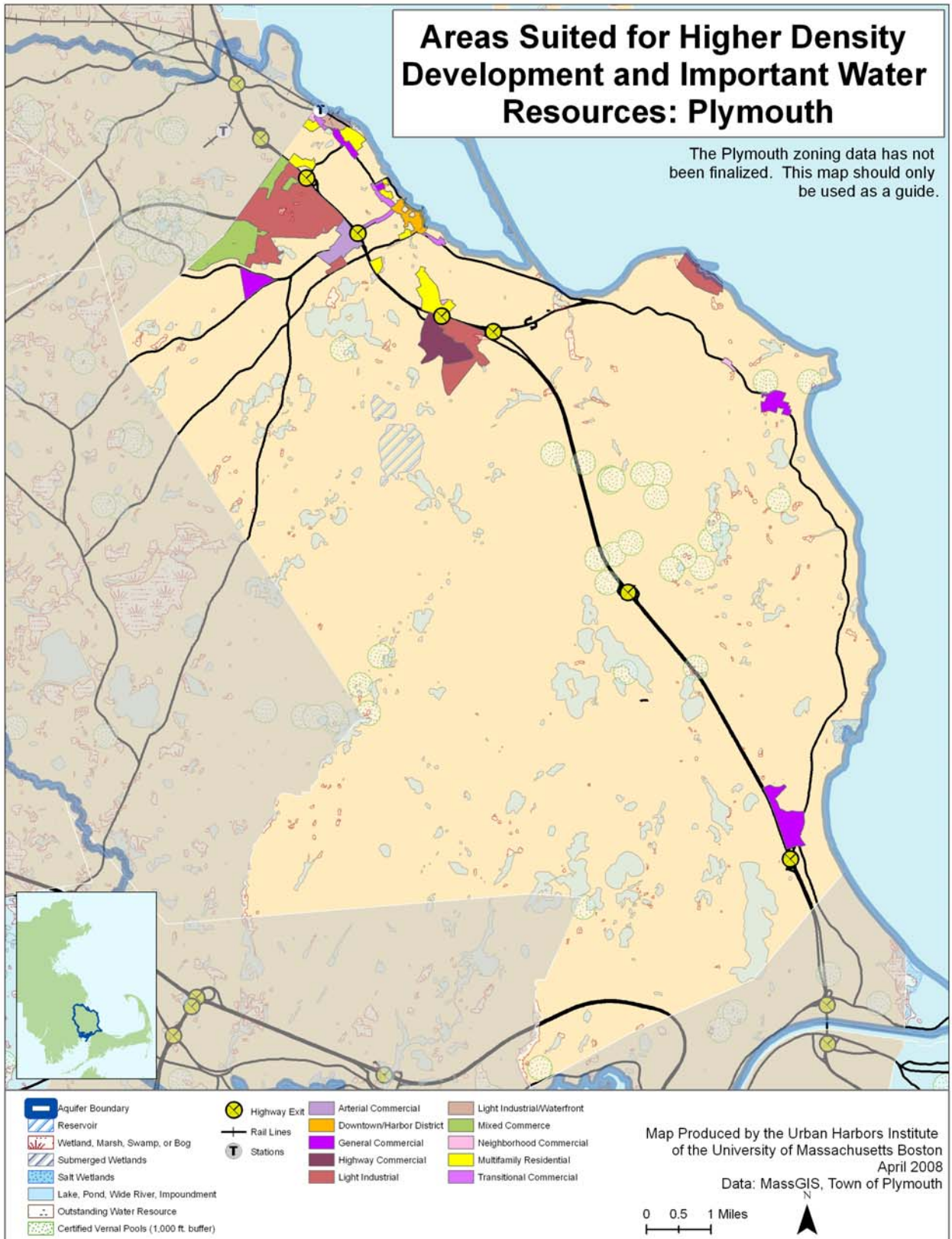
Areas Suited for Higher Density Development and Wellhead Protection Areas: Plymouth

The Plymouth zoning data has not been finalized. This map should only be used as a guide.



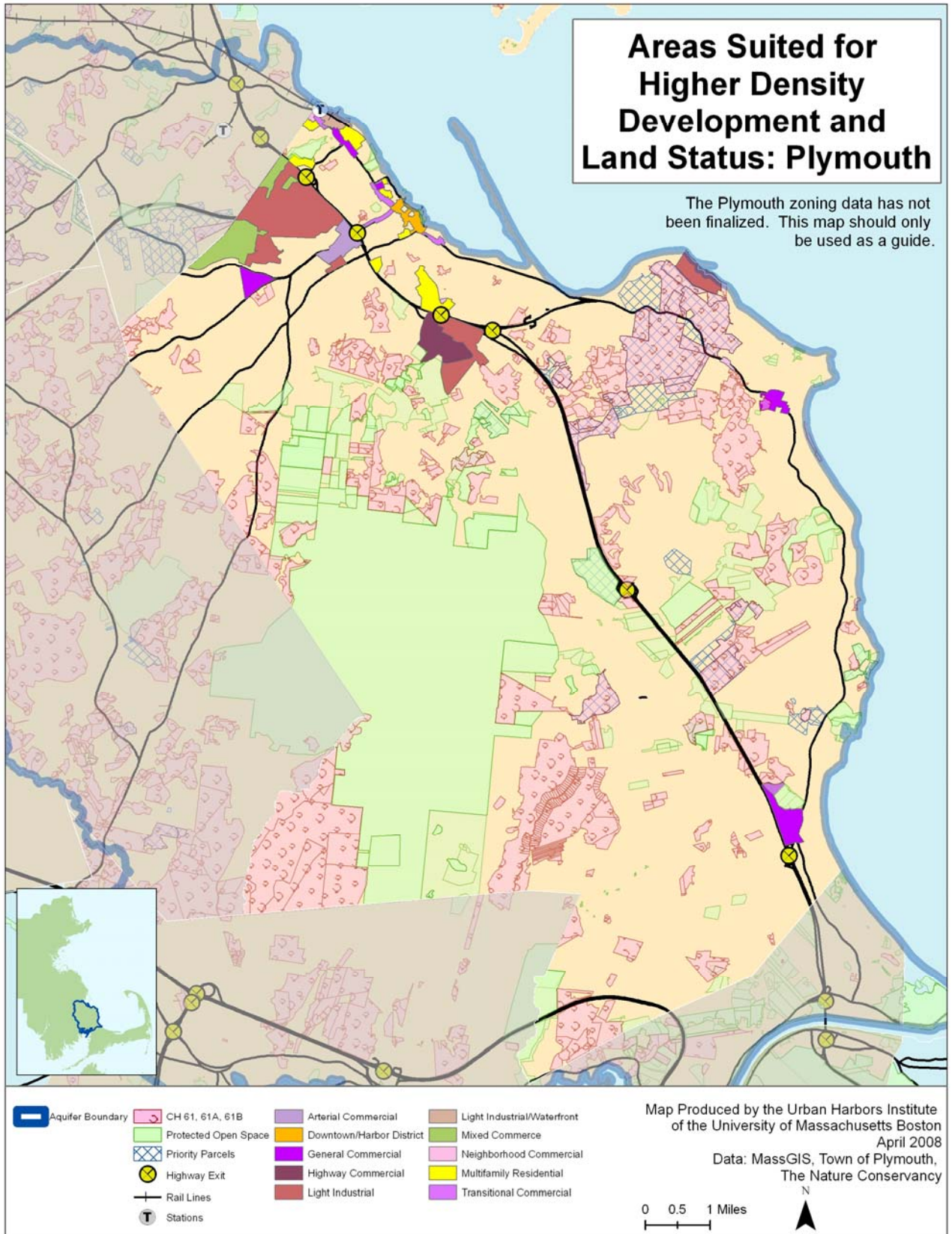
Areas Suited for Higher Density Development and Important Water Resources: Plymouth

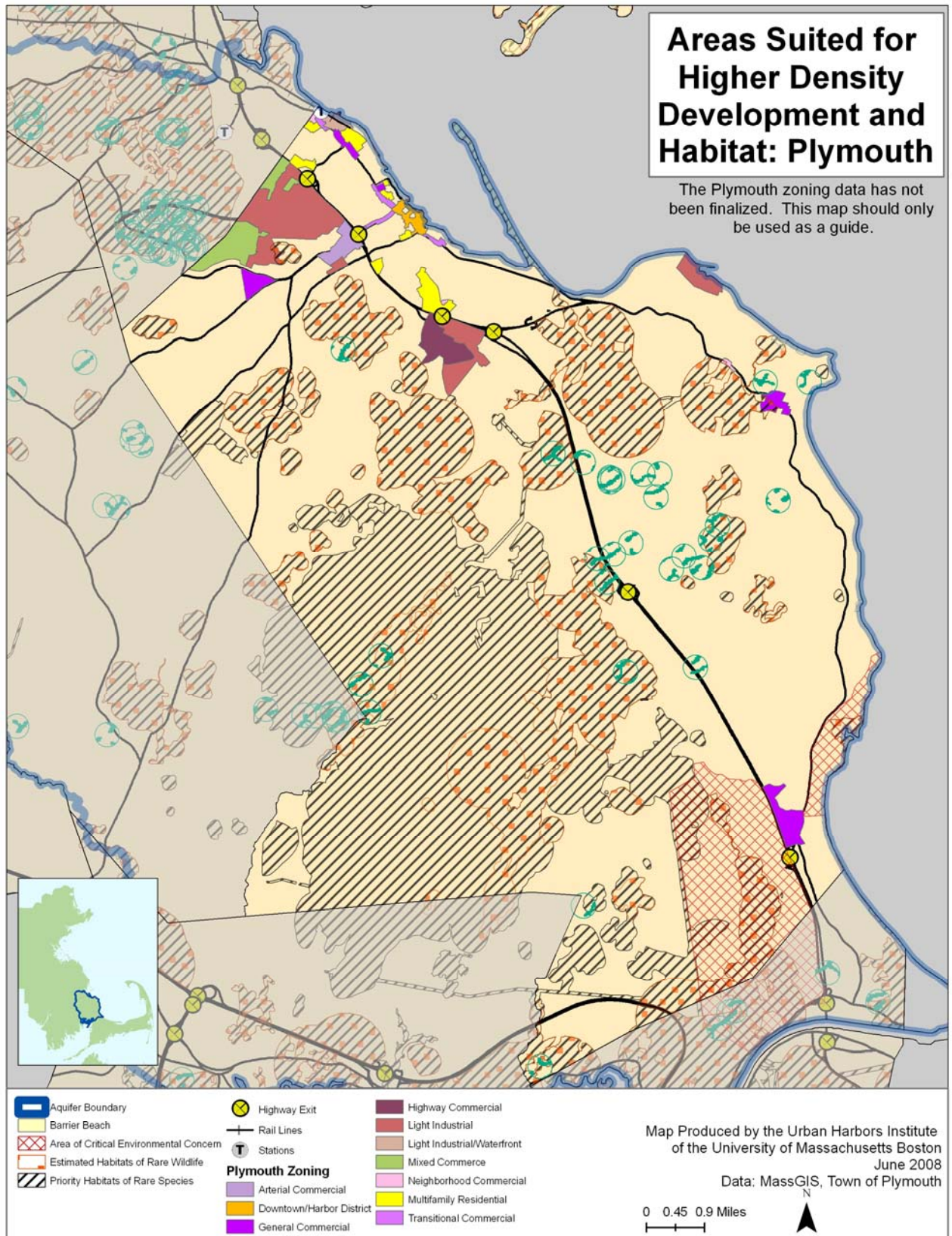
The Plymouth zoning data has not been finalized. This map should only be used as a guide.

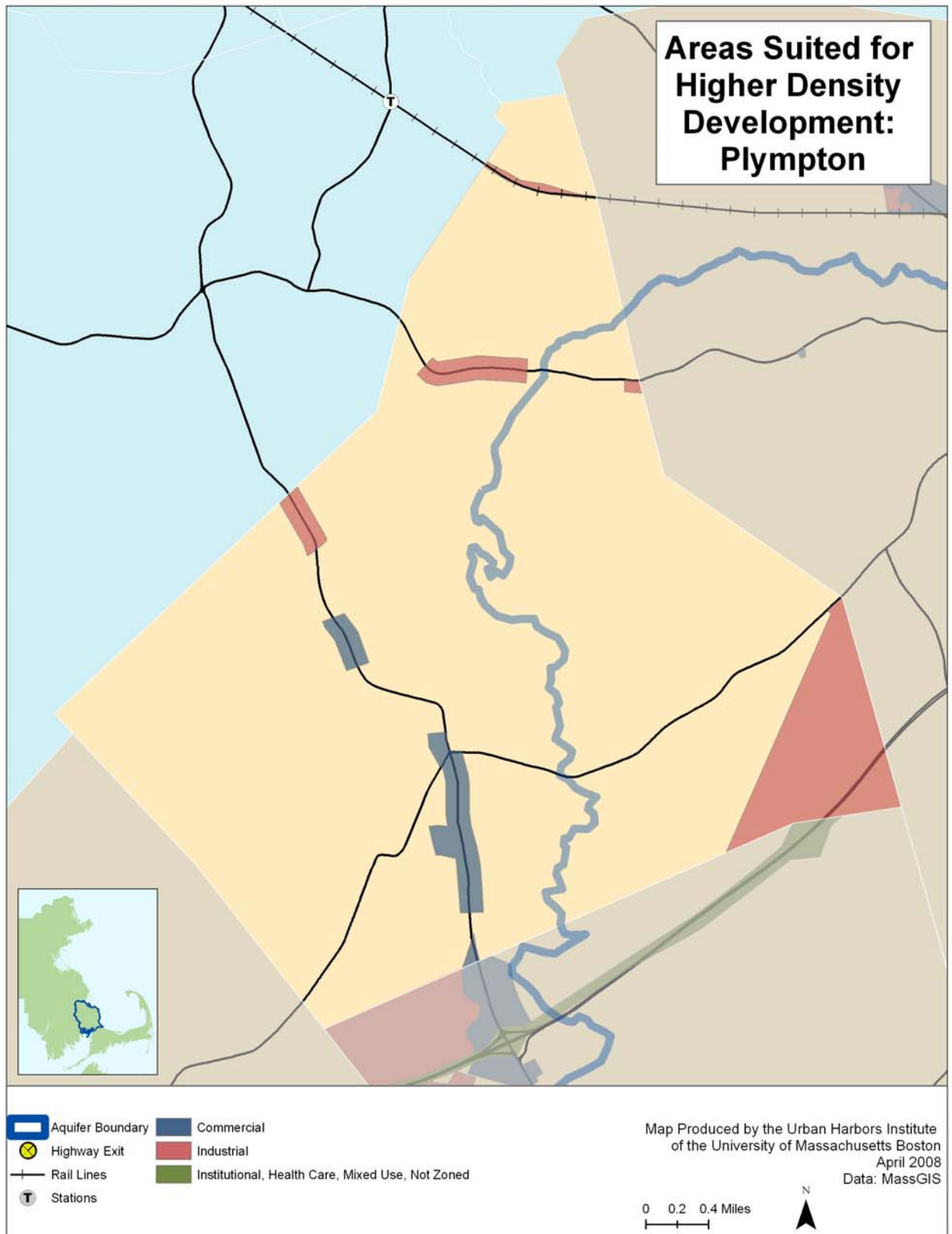


Areas Suited for Higher Density Development and Land Status: Plymouth

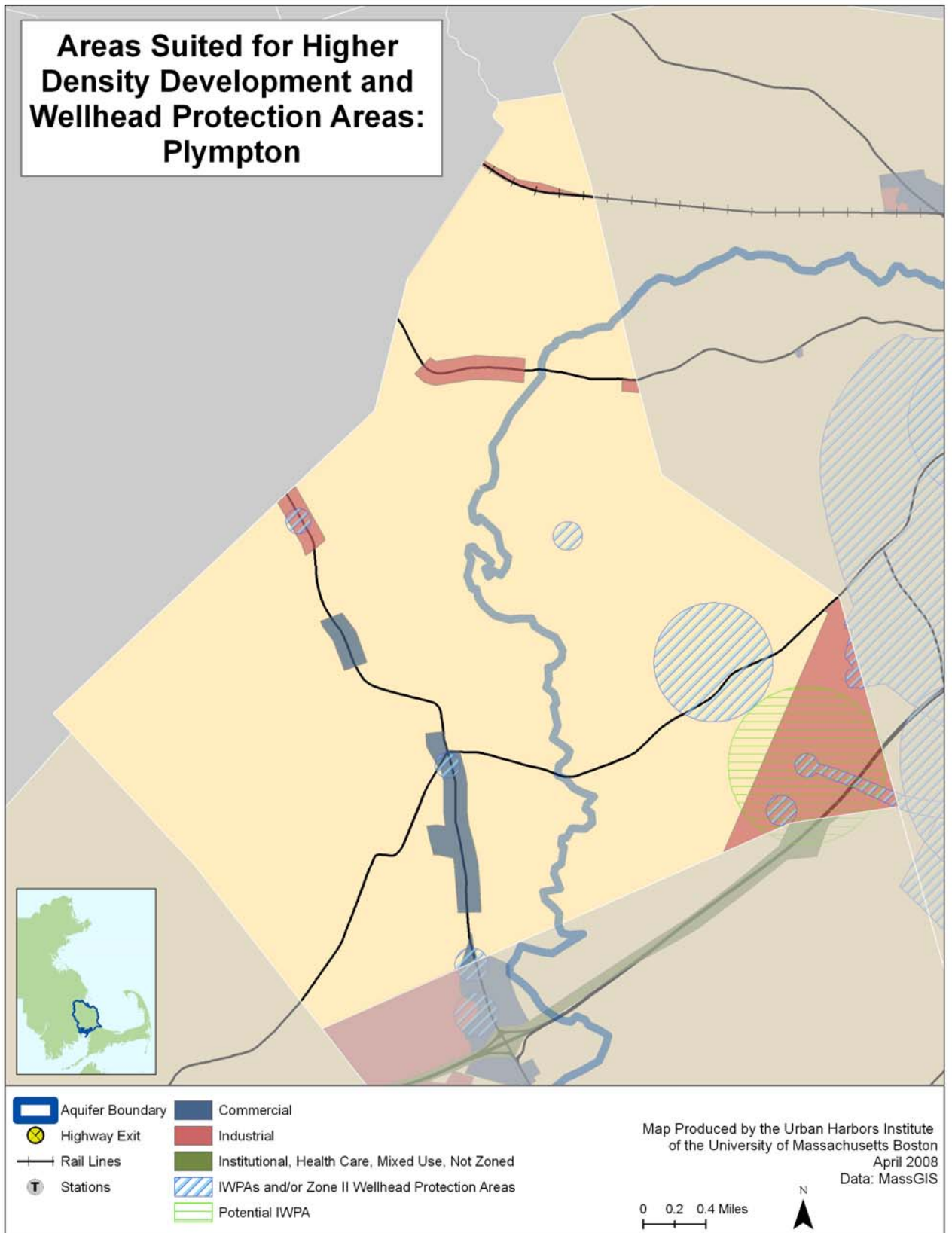
The Plymouth zoning data has not been finalized. This map should only be used as a guide.

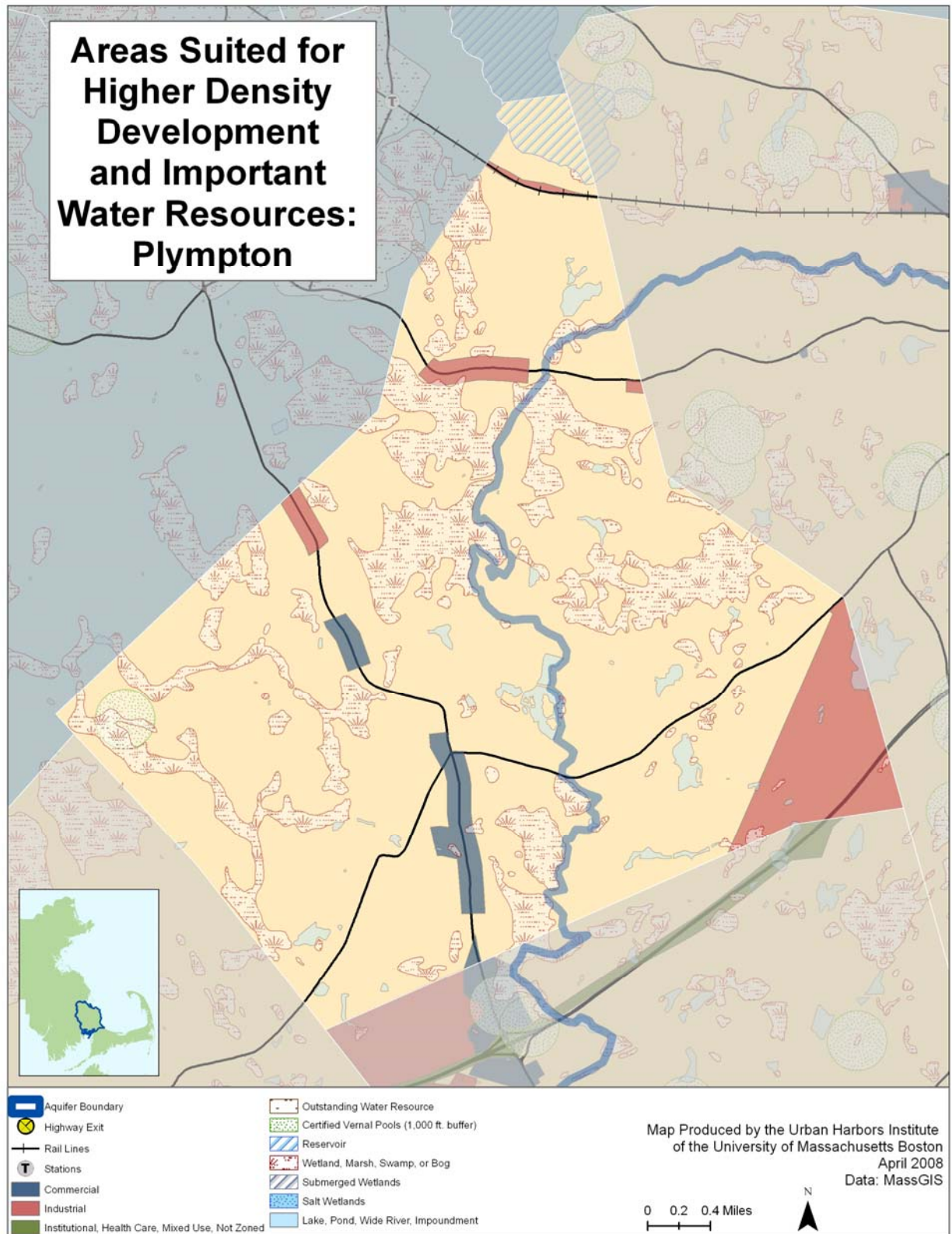


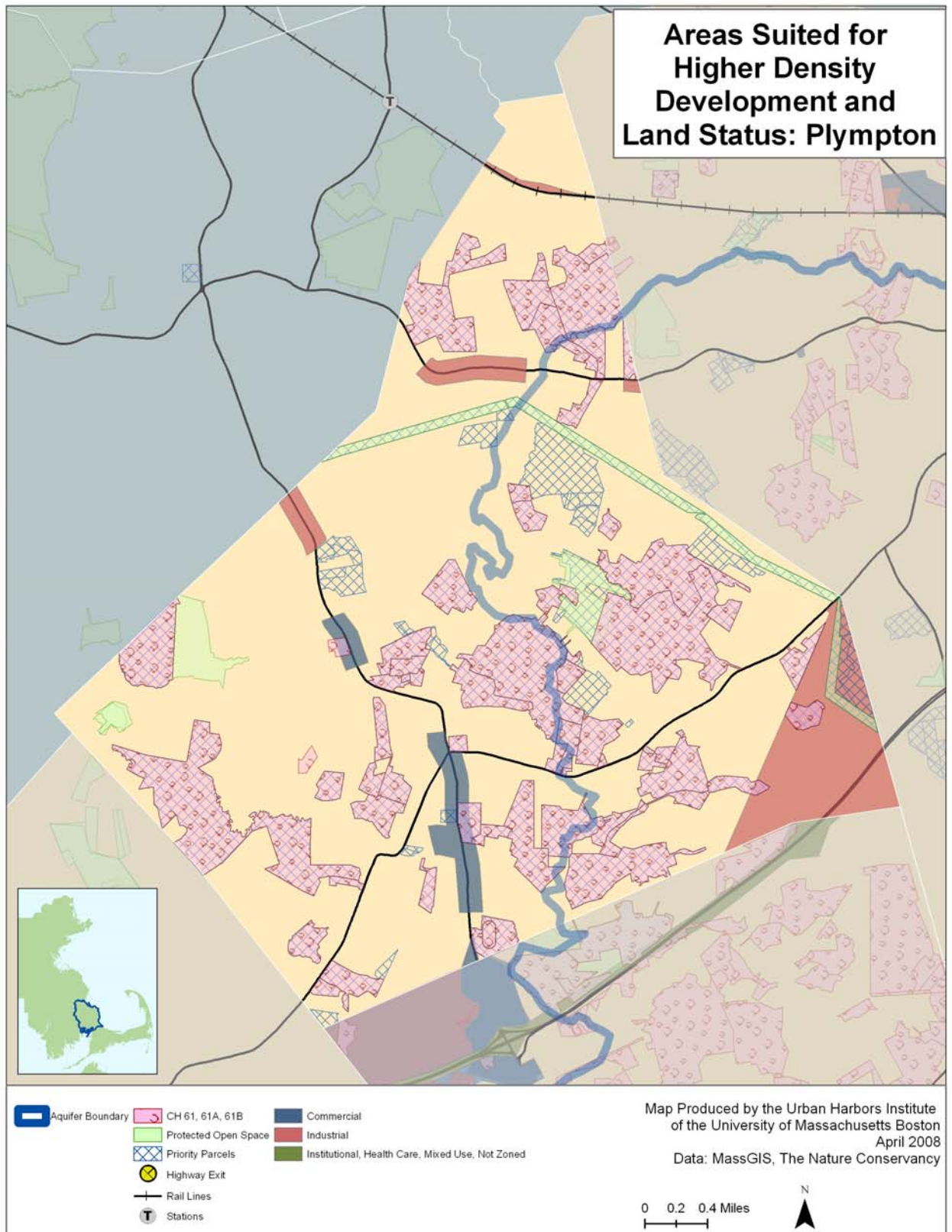


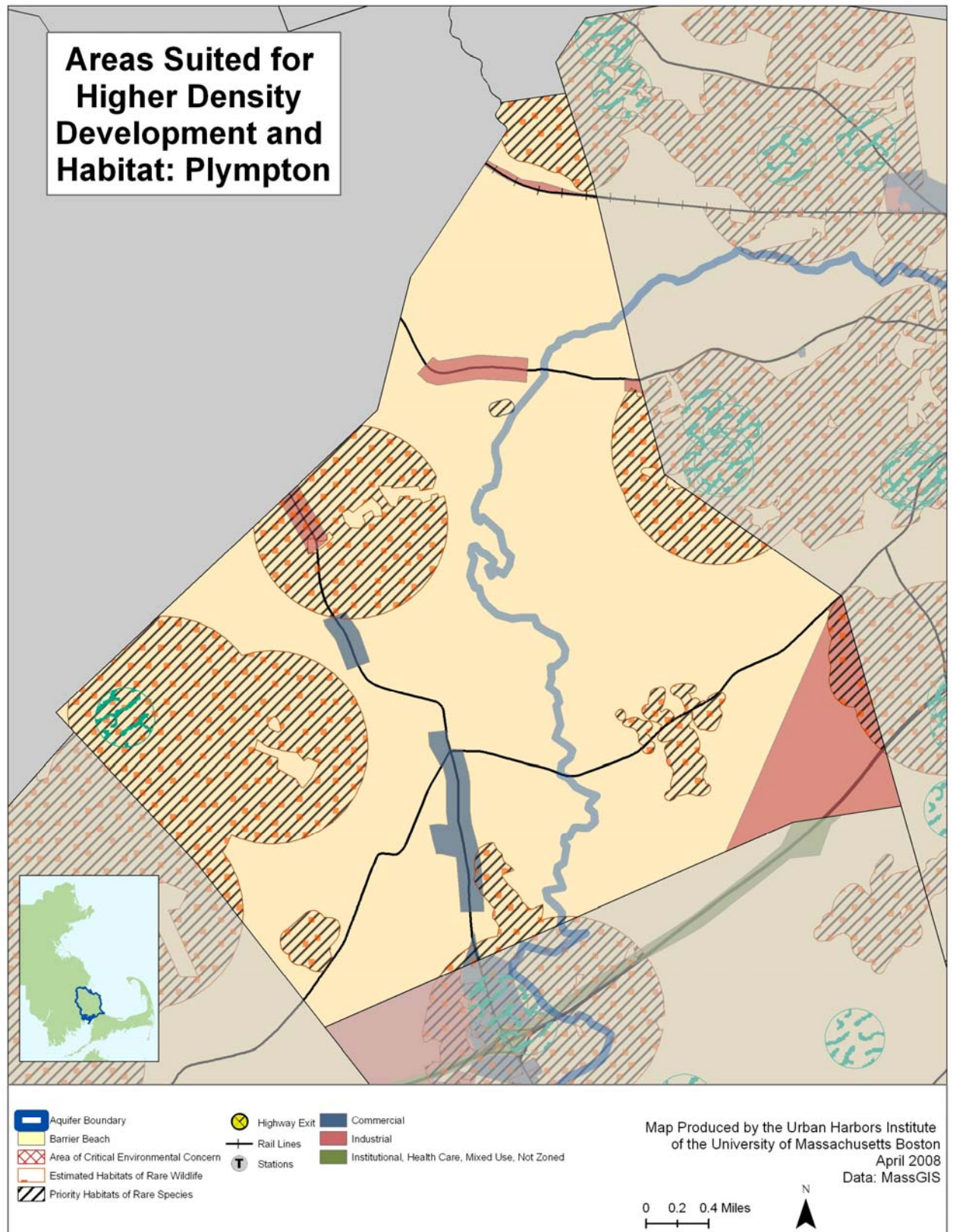


Areas Suited for Higher Density Development and Wellhead Protection Areas: Plympton

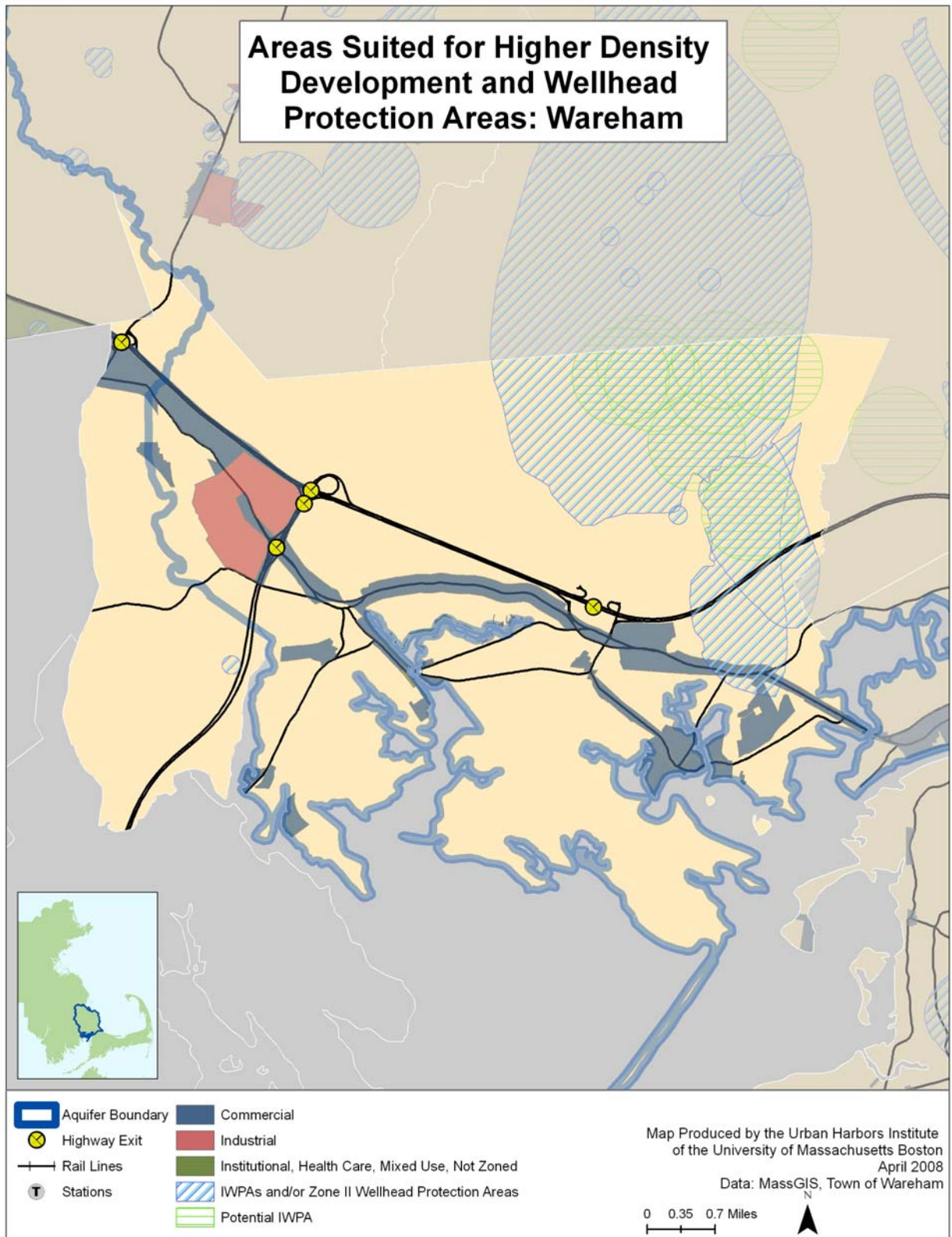




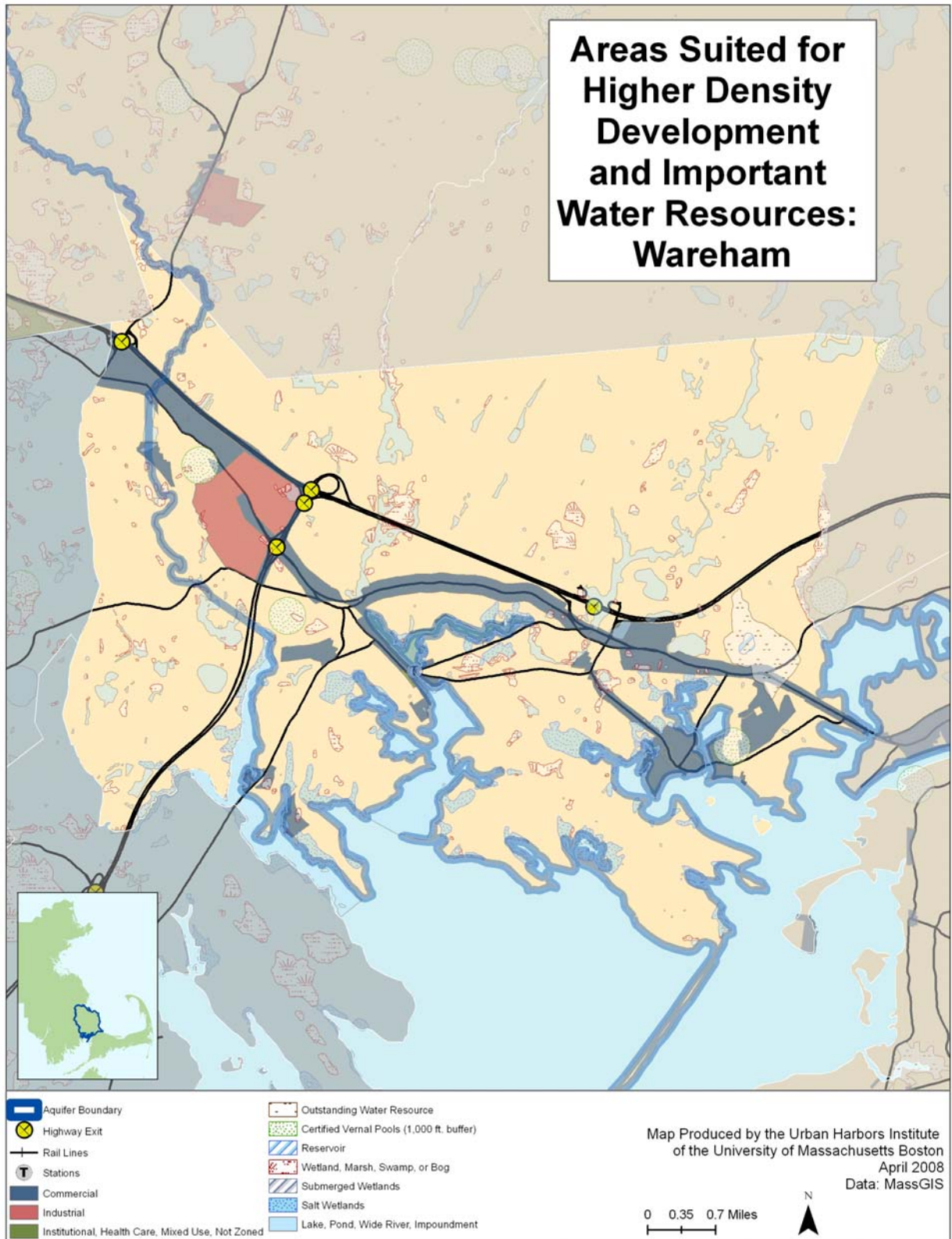




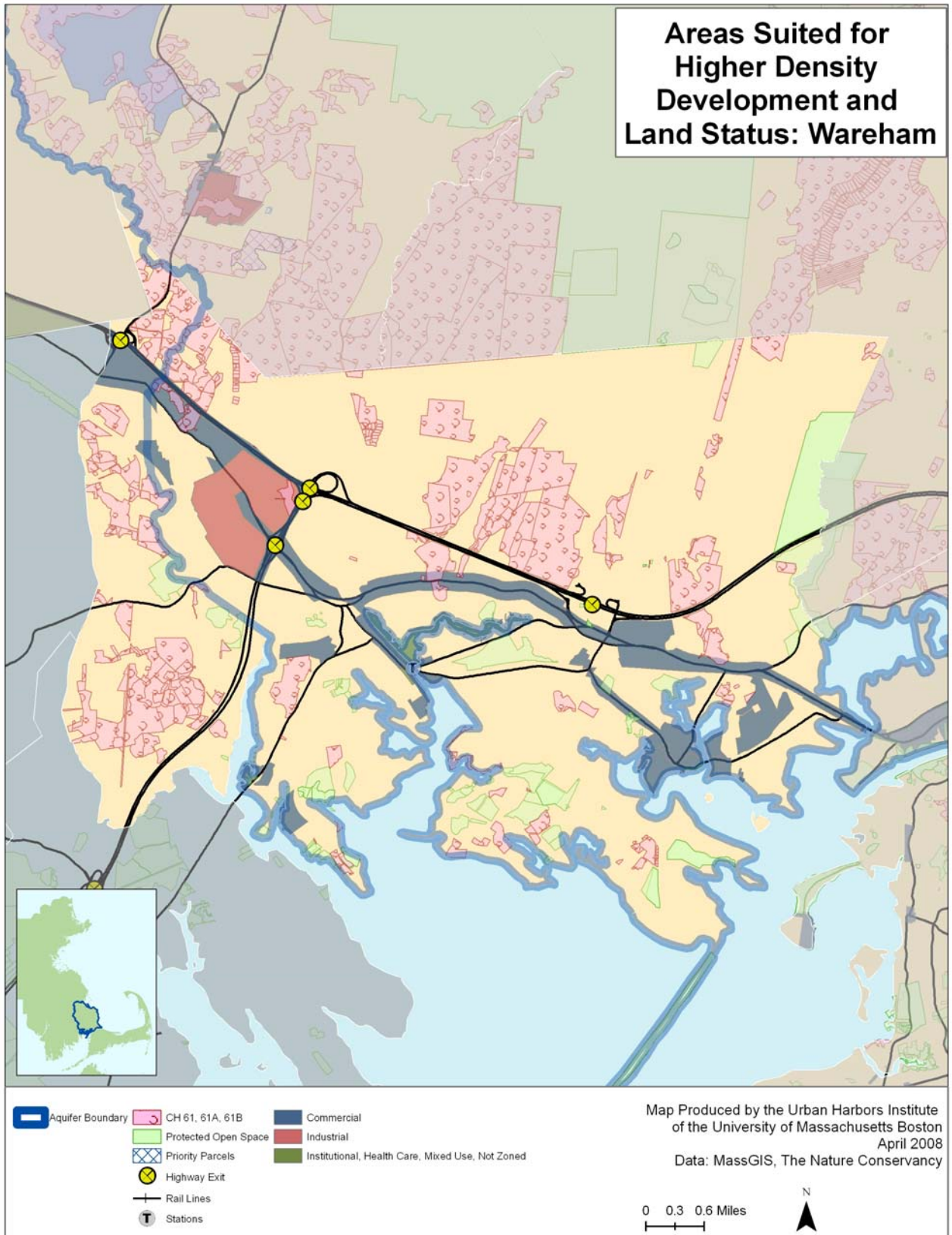


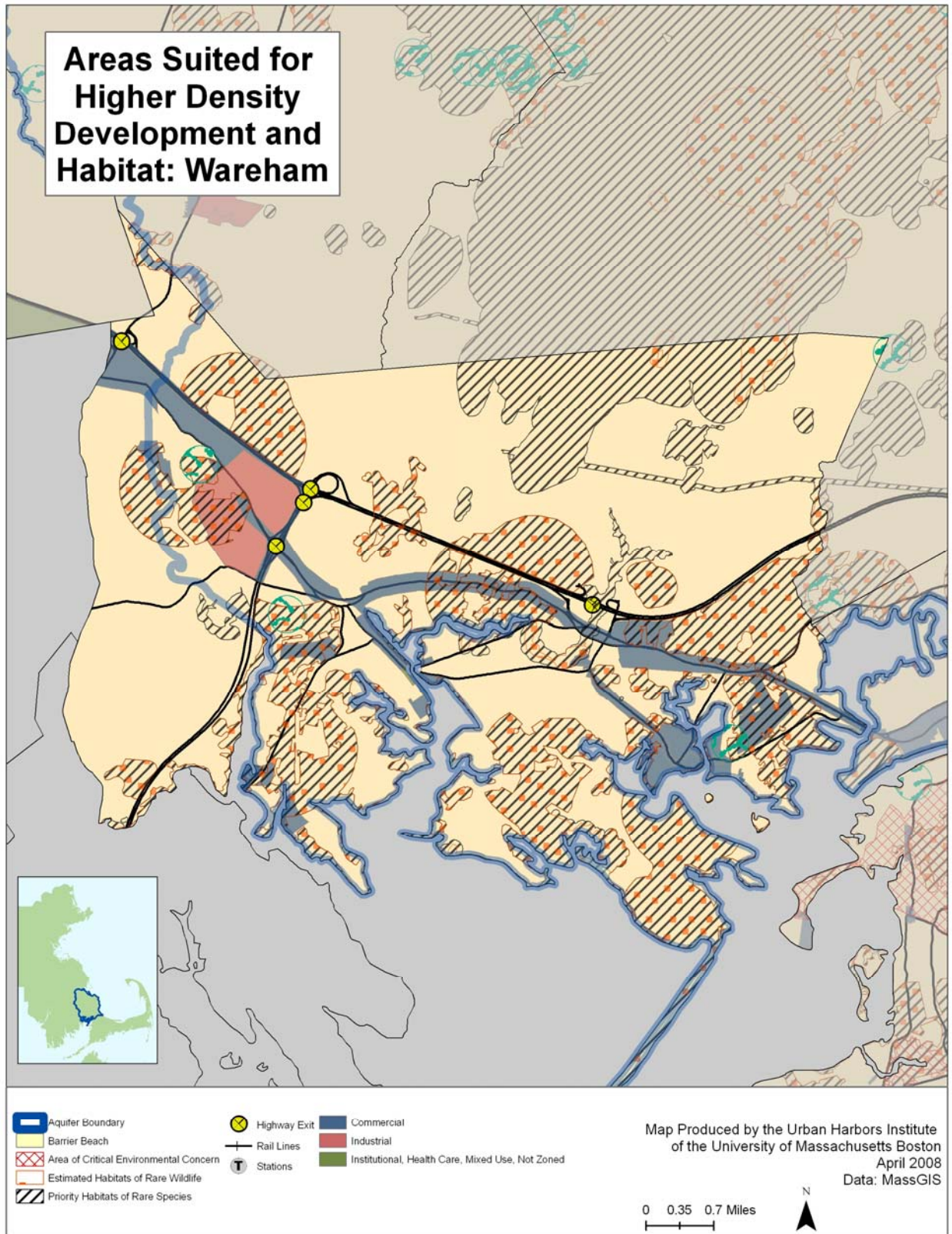


Areas Suited for Higher Density Development and Important Water Resources: Wareham



Areas Suited for Higher Density Development and Land Status: Wareham





APPENDIX D: Plan Review Notes

Plymouth (2007)

Needs: Mentions importance of open spaces for water quality protection. #1 reason to preserve open space is cited as maintaining community character.

Plan refers readers to Amory Engineering's Water System Master Plan (1991) regarding water supply in Plymouth.

Surface water quality – "More water quality monitoring and monitoring for invasive weeds and pond species is needed throughout the town."

Page 73 – Goals (Not prioritized):

1. Achieve a balance of natural resource preservation, residential growth, economic development and financial stability through the judicious use of land use controls that respect development rights and other strategies
2. Ensure that future growth is responsive to a carefully considered assessment of the Town's functional areas, including village centers, growth areas, rural areas, and environmentally sensitive areas.
3. Promote the use of conservation and opens space tools in Plymouth, for both existing and future development
4. Improve the availability and maintenance of recreation areas throughout Plymouth
5. Protect the sources of drinking water supply in Plymouth through the use of open space conservation and management
6. Protect the surface water quality in ponds, wetlands, waterways and coastal waters in Plymouth
7. Maintain the existing scenic views in Plymouth that give Plymouth a distinctive sense of place
8. Maintain the historic character of the town and of individual villages that is found in certain open space land uses and recreational areas
9. Maintain the biodiversity and wildlife habitat in Plymouth

p. 75 – DEM wants to create a wishbone of open space. Plan describes paths the wishbone would take.

From Section VII: Goals & Objectives (page 100-101):

Water Supply

Goal: Protect the sources of drinking water supply in Plymouth through the use of open space conservation and management

Objectives

- Protect land in drinking water protection areas (Zone 1 and Zone 2)
- Identify potential well sites away from rare pond or wetland habitats and work toward their protection through land conservation or regulatory measures
- Identify the water demand potential, stormwater impacts and wastewater disposal needs of large developments and seek impact fees, open space requirements, and other conservation and smart growth tools to mitigate aquifer impacts
- Actively work with neighboring communities that share the sole source aquifer on the

protection and management of water quality and quantity

Surface Water Quality

Goal: Protect the surface water quality in ponds, wetlands, waterways and coastal waters in Plymouth

Objectives

- Protect the lands that provide buffers to surface water to reduce erosion and pollution in surface waters through the use of conservation restrictions, outright purchase, and other conservation tools such as regulatory measures
- Identify a buffer area around wetlands and water courses that can benefit from additional protection, and direct developers and residents to use these areas when conservation easements or set-asides are required for their project
- Delineate the contributing areas to coastal plain ponds in Plymouth and use conservation and open space tools to convert land-uses that are contributing pollution, and to protect strategically located open space
- Continue to monitor water quality in order to identify pollution sources and invasive weeds before they get too severe
- Continue to implement remediation of stormwater pollution to Plymouth Harbor

Note: (page 104) funding for aquifer land protection (mostly for filtration plants, but not exclusively) can be obtained from grants or as a portion of the state revolving loan finds for water quality under the Safe Drinking Water Act. Also, town is considering starting a land bank.

Action Items related to land acquisition, water supply, and surface water (p.107)

- Open space committee will establish goals and objectives for the potential use of right-of-ways
- Open Space Committee should review CH 61 lands and identify parcels that meet priority objectives for the Town, Use the list as a reference for when rights of first refusal arise
- The Town should discuss the future of the approx. 1600 acres of open space surrounding the Entergy nuclear facility
- Work with the DPW to identify potential well sites away from rare pond or wetland habitats and work toward their protection through land conservation or regulatory measures. Identify parcels that may, through preservation, contribute to the protection of groundwater and drinking water supplies.
- Continue to implement the 1991 Water Supply Master Plan, with an analysis of any impacts proposed well sites have on rare habitats or pond water levels.
- Review larger developments for comment on potential impact fees, or other mitigation factors that might be applicable, based on an assessment of anticipated impacts
- Actively work with neighboring communities that share the Sole Source Aquifer on the protection and management of water quality and quantity. Attend the meetings of the proposed multi-town aquifer task force.
- Protect lands that provide buffers for surface water to reduce erosion and pollution in surface waters through the use of conservation restrictions, outright purchase, and other conservation tools such as regulatory measures
- Identify a buffer area around wetlands and water courses that can benefit from additional protection, and direct developers and residents to use these areas when conservation easements or set-asides are required for their project

- Delineate the contributing areas to coastal plain ponds in Plymouth and use conservation and open space tools to convert land-uses that are contributing pollution, and to protect strategically located open space
- Continue to monitor water quality in order to identify pollution sources and invasive weeds before they get too severe
- Continue to implement remediation of stormwater pollution to Plymouth Harbor

Plymouth appendix has criteria for ranking open space acquisition – including for water supply and surface water quality (page 119)

Inventories of protected and unprotected open space, and;
All relevant mapped material

Plymouth Strategic Action Plan

One of six **guiding principles** regarding future growth:

Protect the environment (p. 3)

Plymouth is a significant center of biodiversity and lies above the second-largest aquifer in Massachusetts.

The Policy Context for Decision–Making, (p. 3) includes:

- Plymouth needs to protect critical natural and historic resources, but the Town cannot protect all critical resources by purchasing land or development rights.
- The Town will use a combination of incentives and regulation to shape both preservation and development decisions.
- The Town will use public-private partnerships where possible to achieve the community's goals through implementation of the Master Plan.
-

Plymouth at the crossroads (p. 6)

Land Available for Development

Except for the state forest, Plymouth has a relatively small amount of permanently protected open space and a large amount of open land that could be developed under current zoning as large-lot single family houses.

Much of this land is fragile pine barren country. More sprawling development could deplete the water table, increase pollution of ponds and streams and contaminate the aquifer,

The Master Plan Alternative (p.8)

Smarter growth means investing in both Green Infrastructure and Growth Infrastructure.

Green Infrastructure is the interconnected system of land and water resources that sustains a healthy environment for Plymouth's people and its wildlife.

PRESERVATION AREAS where the goal is to constrain development and preserve open space:

- The Town should be committed to focusing open space preservation in these areas.
- Open space should be protected for environmental, scenic, cultural, recreational and fiscal reasons through a variety of methods in addition to acquisition.

KEY ACTIONS TO SET THE FRAMEWORK (p.9)

- Establish natural resource and open space and cultural heritage networks (Green, Blue and Cranberry Networks).
- Establish Growth Areas and Preservation Areas.



GREEN NETWORK

GOALS:

- Link open space and wildlife habitat throughout Plymouth in a Green Network.
- Preserve sensitive ecosystems, habitats and wildlife corridors.

HOW?

- Evaluate and rank unprotected open space resources according to criteria for environmental sensitivity and scenic and cultural value.
- Work with nonprofit conservation organizations to protect critical open space.
- Seek donation of conservation restrictions from landowners, who will benefit by reduced property taxes.
- Establish low maximum densities in Rural Preservation Areas.

- Establish development standards with incentives for protection of large blocks of open space, public access, or other public benefits.
- Seek additional dependable revenue streams for conservation purposes.

BLUE NETWORK

... Plymouth's ponds and streams are the surface manifestations of an immense underground aquifer, the 199-square-mile Plymouth-Carver aquifer. It is Plymouth's sole source of drinking water. Currently in good condition, it remains vulnerable to contamination from development impacts on very permeable soils. . .

GOALS:

- Protect and enhance the Blue Network of inland and coastal water resources, including wetlands and aquifer connections.
- Protect the quality and quantity of groundwater and surface water.
- Promote public awareness of best practices in private landscape management to protect water resources and wetlands.
- Expand opportunities for public access to water.

HOW?

- Identify the recharge areas to large ponds and major waterways.
- Implement a town-wide stormwater management plan.
- Review subdivision and building requirements to promote lower impact development.

Carver (2004)

(from page 2) Goal II: Preserve the quality of Carver's natural resources, including ground and surface waters, wetlands, and wildlife habitat.

Objectives:

- 1) Protect Carver's groundwater resources.
- 2) Preserve and restore water quality in Carver's rivers, streams, and ponds.
- 3) Support protection of wetland resources and areas bordering wetlands throughout Carver.
- 4) Encourage retention of existing cranberry grower-owned lands as wildlife habitats, water recharge areas, etc.
- 5) Preserve critical wildlife habitats.

"The needs addressed in an Open Space Plan include: to maintain environmental quality, to protect and preserve ground and surface water, to provide a balanced recreation plan to meet the needs of a growing population, to preserve and promote natural areas for conservation purposes, and to integrate conservation and recreation areas."

No public water and sewer in Carver (p. 7) "Unfortunately, this groundwater has been threatened in certain locations. A plume of contamination emanating from the North Carver Landfill has spread under a number of homes and affected Muddy Pond. Affected residents had to be hooked up to public water from Middleborough while the cleanup of this site was underway. The site has been remediated and will be capped by the town. Another plume of contamination has been discovered down the road at the privately owned Ravenbrook

Demolition Landfill. While this plume has not yet affected private wells, nearby neighbors have also been hooked up to the Middleborough water main as a precaution.”

Approximately 12,259 acres, or about 48% of the land in Carver, is kept in an open, agricultural condition by the cranberry industry.

In Carver, the Village Center districts would be appropriate receiving areas for development rights transfers. Sending areas could be anywhere else in town, or limited to a specific district. A TDR bylaw should be stated in such a way as to ensure that lands from which the development rights are transferred are permanently protected from development.

The highest priority is to link local and regional open space assets. These primary corridors connect critical regional open space parcels such as Myles Standish State Forest, the Great Cedar Swamp, and the Edaville area, as well as town-owned land. The second priority is to protect adjacent, secondary water and resource areas and views. These corridors link many of the town’s wetlands, floodplains, ponds, streams, and wildlife habitat areas. The third priority, Buffer Bogs, seeks to retain important agricultural bogs and resources.

Plan lists protected and unprotected parcels.

Well fields and water supply areas need to be protected

In response to the community survey conducted during the revision process of the Carver Open Space and Recreation Plan, citizens of Carver expressed concern about a range of environmental issues. Foremost of these concerns was the protection of “well fields and water supply areas”. Ninety-three percent of respondents feel the protection of wells is an issue that needs to be a high priority for the town. This sentiment reflects the very real threat that faces Carver’s drinking water supply. Physical characteristics of the aquifer combined with the development pressure Carver is experiencing makes it essential that the town implement well planned, long-term programs, such as the creation of a multi-town watershed advisory board, that addresses drinking water supply issues. In addition, protection strategies such as land acquisition, conservation restrictions, and adopting appropriate zoning regulations are important methods to pursue.

Goal II: Preserve the quality of Carver’s natural resources, including ground and surface waters, wetlands, and wildlife habitat.

Objective 1: Protect Carver’s groundwater resources.

- a. Work with the towns of Plymouth and Wareham to protect the Plymouth-Carver Aquifer by participating in the formation of a watershed advisory board.
- b. Protect land (especially land over the Plymouth-Carver aquifer) by purchase or conservation restrictions, using state and federal funds whenever possible and assistance from land trusts.
- c. Identify and protect sites designated as potential sources of public water.

Objective 2: Preserve and restore water quality in Carver’s rivers, streams, and ponds.

- a. Establish a monitoring program of major town water bodies to identify problem areas and oversee the correction of them by appropriate town agencies.

- b. Regulate and enforce stormwater management through the cooperative efforts of various town officials and boards.
- c. Encourage use of landscaping and agricultural practices that minimize erosion and nutrients from fertilizers entering surface and groundwater.

Objective 3: Support protection of wetland resources and areas bordering wetlands throughout Carver.

- a. Work with the school system and other interested groups to document and inventory vernal pools and other wildlife habitat in Carver.
- b. Amend zoning by-law to require a minimum upland area on new lots created in town to limit encroachment on wetlands.

Objective 4: Encourage retention of existing cranberry grower-owned lands as wildlife habitats, water recharge areas, etc.

- a. Encourage tax policies, such as a tiered tax, that will support the financial viability of the cranberry industry and tax each grower at the proper rate.
- b. Encourage State and Federally supported programs that help growers maintain their land as wildlife habitat, water recharge areas, etc.

Objective 5: Preserve critical wildlife habitats.

- a. Protect lands identified by the Natural Heritage and Endangered Species Program as critical habitat for rare and endangered species.

Kingston (2001)

Most residents are served by the Kingston Water Department – 6 wells and 3 storage tanks. Plan includes map (Map #4) of existing and potential wells

The goals of the open space plan are

- Preservation of undeveloped land, natural resources and natural systems
- Provide opportunities for active and passive formal and informal participation in recreational activities for all residents.

Town adopted a water resources district zoning by-law to prevent contamination. They want(ed) also to limit fertilizer use.

Town mapped zones of contribution for potential future well sites (See “Water Resources Map Protection Districts and Public Wells” map 1990)

Goal 1—Protect the Quality of Kingston’s Natural Environment

Objective C: Develop and implement management plans to improve and maintain surface water quality through management of sewage, street runoff, as well as other runoff.

Goal 2—Ensure that the land use activities will be compatible with maintaining the quality of local water supplies.

Objective A: Coordinate recreation and conservation land acquisitions with the Water Department to the fullest extent possible

Objective B: Ensure that local land use control powers are used to the fullest extent possible to protect the quality of present and future public water supplies.

Goal 5—Encourage land use activities which preserve privately owned land as open space

Objective A: Promote participation in voluntary restriction programs including CH 61, 61A and 61B

Objective B: Encourage donations of conservation easements

Objective C: Encourage developer use of RDEOS (Residential Development Encouraging Open Space) passed as Zoning Bylaw in 2000.

Plan includes a list of protected and unprotect land with description.

Wareham (2004)

Residents get water from private wells and the water departments of the Onset Fire District and the Wareham Fire District – both withdraw water from the aquifer.

The town has 54 miles of coastline – the most in the state.

Most of the land within the aquifer is low-density residential. The minimum lot size in the agricultural watershed district is three acres. Zoning changes and timing have allowed some higher-density residential developments and some commercial uses though. (p. 27)

The plan includes a list of protected and unprotected lands along with the acreage for each parcel.

Approved the CPA by 75% in 2001

Formed the Wareham Land Trust in 2002.

Resource Protection Needs –

“...Wareham residents are most concerned with preserving their watershed, waterways, and bays from encroaching development, overuse, and deterioration. The Town’s water supply is from well fields in Onset and north of 495 in Wareham. The Town continues to believe that the Plymouth-Carver Aquifer should be designated and area of critical environmental concern and will redouble efforts to achieve that designation.” (p. 75)

Goal 1—Preserve and protect Wareham’s unique natural open space resources

Objective 1. Protect Wareham’s extensive water resources including coastal waters, river systems, drinking water supply, ponds, and wetlands.

Objective 2. Acquire strategically located parcels of land to prevent development in inappropriate areas.

In the survey in the appendix, the respondents were asked to rank the top 3 priorities for the open space plan. Number one was the acquisition of land in aquifer watershed to protect drinking water supplies. While this was the public’s number one priority, the importance was not really stressed in the plan compared to protecting coastal resources and developing recreational opportunities.

Middleborough (1998)

Middleborough is the 2nd largest town in MA by area

The plan discusses the importance of drinking water as well as the sources of drinking water – but there is no mention of the aquifer.

Plan contains an inventory of existing open space conservation and recreation lands with descriptions. It also contains a list of protected parcels and descriptions.

Resources Protection Needs include protection of current and future drinking water supplies (p. 66)

Community needs include the preservation of air, water, and sound quality (p. 68)

Goal—Protect ground water resources including current and future well sites, Zone IIs, and Zone IIIs. (p. 73)

- Objective: Evaluate and prioritize parcels necessary for protection of existing well sites
- Objective: Acquire by gift, purchase, conservation easement, or conservation restriction, land to protect well heads, particularly land adjacent to well heads.
- Objective: Identify and protect current and future well sites from road-borne pollutants, septic systems, and other off-site impacts.

Goal—Protect surface water bodies and riparian lands (p. 73)

- Objective: Identify and prioritize parcels along surface water bodies and riparian lands for acquisition, conservation easement, and/or conservation restriction
- Objective: Acquire property as it becomes available by gift, purchase, easement on pond fronts, particularly along the Assawompset Ponds complex.
- Objective: Promote conservation easements and voluntary conservation restrictions in sensitive watershed areas in cooperation with town, regional, and state agencies.

Bourne (1997)

Most of the land in Bourne north of the canal is in the Buzzard's Bay Water Resource District. (Map on IV-11a)

Plan lists and briefly describes protected and unprotected land.

General goal # 5 (p. VI-2)—“The Town’s overall goal regarding water resources is to assure continuation of high-quality drinking water without the need for treatment, and preservation or restoration of the ecological integrity of marine and fresh surface waters. We seek to achieve those goals in a way which is as consistent as possible with other planning objectives, such as those for housing, economic development, and land use.”

Resource Protection Need #1 – Water supply (p. VII-I) “The leading environmental concern in Bourne since the discovery of the migrating Massachusetts Military Reservation plumes and subsequent closure of several wellheads, is that additional pollution and continued development will cause widespread contamination of the Town’s water supplies. Generally,

poorly managed growth can result in a two-sided effect on groundwater resources: 1. Increased consumer demand and dependence on groundwater for a variety of domestic and commercial/industrial uses; and 2. increased land development which may result in extensive contamination and decreased groundwater recharge.”

The Town is evaluating additional well locations and is focused on making sure it can meet demand.

Recommended actions regarding the water supply: (p. VII-3)

- Enforce the provisions and performance standards of the Water Resource District Overlay Zoning.
- Update the zoning bylaws as changes are made to the State’s wellhead protection plan.
- Consider providing relocation assistance to incompatible uses.

The number one concern of survey respondents was water pollution (did not specify drinking or other water)

Goal 1. Community Character, *Open Space*, and Recreation

- Objective: Give priority to those open space acquisitions within identified critical resource areas, Water Resource Districts, as well as the Hen Cove and Pocasset River Watersheds.
- Objective: In the design stage of developments, significant natural and fragile resources areas should be taken into account. Every effort should be made to protect and preserve critical wildlife, plant habitat, water resources such as lakes, rivers, aquifers, shorelines, wetlands, and historical, cultural, and archaeological areas, significant scenic roads and views, and significant landforms.

Plan includes a list of priority open space acquisition parcels – give specifics such as owner and map and parcel number.

Action Items for Water Resources Protection (p. IX-8):

- Make full or partial purchase of land rights within the Water Resources Protection Districts a priority.
- Seek funding to develop a model scheme for Pocasset Village to reconcile the objectives of compact village development with concerns for water quality protection.

Plympton (2008 Draft)

Much of the town is wetlands (already protected by state and federal laws)

No municipal sewer or water

Most rural town in Old Colony Region. Most growth is new houses on big lots and horse farms.

Population in 2000 – 2,801

Major factors affecting present and future land uses are the 3,500 acres located in the local Floodplain and Watershed Protection zoning district, the (often overlapping) land with

significant limitations for on-site sewage disposal, and the areas in the more recent Groundwater Protection Districts. These protective restrictions are vital for a community with extensive flood plains, on-site waste disposal, and no municipal water service. See zoning section 3.4 – Growth and Development Patterns. (p. 4)

The town's only fully protected private land include (p. 4-5):

- 17 acres on West Street, along the Winnetuxet River near the town line. Property is owned and maintained by the Wildlands Trust
- 3.5 acre riverside parcel near the intersection of Main Street and Winnetuxet Road – purchased with state assistance. It has a now abandoned man-made swimming hole with a “No Swimming” sign
- A long, thin 2 acre common and adjacent 14 acre cemetery along Main Street
- The large, largely undeveloped 50.3 acre Jason Park site south of Center Street near the Halifax. May develop ball fields and allow for in-town camping in the future

The town owns approx. 313 acres (Need to verify)

- 82 acres south of the Dennett School – reportedly purchased with state assistance, but are not under Con Com management or otherwise fully protected. This area is largely in the flood plain district
- 53.3 acres in Jason Park

They have 3 overlay districts: (1) The Floodplain and Watershed protection district, (2) the Groundwater Protection District, and (3) the Harrub's Corner Historic District

- The Groundwater Protection District is divided into 3 sub-districts based on water usage, but none prohibit normal residential development.

Some landscape features highlighted –

- Turkey Swamp – Large wooded swamp between Maple and Country roads with a large area in Halifax.
- Cato's Ridge (Kato's Hill/Ridge Hill) – A series of relatively high hills north of Ring Rd. just beyond the Martin Hayward Sawmill
- The Center Street Road Palmer Road Meadow Lands – open fields, wet meadow, and fresh marsh south of the Halifax Line

Southeast portion of town is in the Plymouth-Carver Aquifer

Town protects groundwater through Groundwater Protection zoning districts adopted in 1991.

Is there a 1 acre public access parcel along Bonney Pond?

Plan has extensive lists and descriptions of parcels: Protected Public Parcel (p. 50), Protected Nonprofit Parcels (p. 51), Town-owned land, largely tax-title, Other Tax-Exempt Land, Chapters 61, 61A, and 61B lands (see p. 59-81), Unprotected Lands of Conservation Interest. (Pages 82-87)

The plan recognizes the importance of thinking in terms of a regional approach (not just with open space, but with schools, emergency services, etc.)

Community Vision (p. 89) – Rural/suburban town with scattered housing along existing roads and in small developments, compact neighborhoods, scattered outlying neighborhoods mixed with extensive continuing farmland, and a network of varied open spaces generally connected to each other, along with protected open space near all existing or probable neighborhoods, a compact readily accessible town center, and a range of low-key recreational opportunities.

Goals & Objectives:

Goal 1—To protect and preserve the town’s natural resources for the benefit of present and future generations

- Method: Protect and preserve riparian, watershed, and wetland areas, including streams, rivers, ponds, lakes, and vernal pools.
 - Objective – Implementation of an annual household waste, oil, and hazardous material disposal day by the BOH and Con Com.
 - Objective – Confirm present NHESP mapped potential and existing vernal pools
 - Objective – Accomplish this plan’s diverse proposals
- Method: Protect surface water quality through regulations, acquisitions, and other tools.
 - Objective – Inclusion of LID principles in the Subdivision Rules and Regulations
 - Objective – With Planning Board, review protective provisions of the Floodplain and Watershed Protection District bylaw and draft any revisions
- Method: Protect public and private groundwater supplies, including portions of the town that fall within the Plymouth-Carver Aquifer
 - Objective – Evaluate the town’s specific groundwater resources, water supply needs, and existing land use regulations in cooperation with the BOH and the BOS
 - Objective --With Planning Board, review Plympton’s Floodplain and Watershed Protection District map to potentially include extensive recharge areas if appropriate
 - Objective – Identify/rank groundwater supply and recharge areas from the maps of Groundwater Protection Zoning Soil Limitations for Septic Systems or other sources.
 - Objective – In conjunction with the Planning Board and the Board of Health, review the Groundwater Protection zoning bylaw and other land use regulations to restrict which may pollute the aquifer; and prepare any needed revisions
 - Objective – Determine the significance of town holdings to ground water protection. Use this information to set priorities for acquisition and development of management principles
- Method: Protect and preserve unique estimated and priority wildlife habitats
- Method: Promote public awareness of natural resources and recruit assistance in their protection
 - Objective – Increase public awareness and support for acquisition
 - Objective – A public that understands existing regulations protecting wetlands, waterways, water bodies, floodplains and wildlife, and reports prohibited practices
- Method: Promote eco-sustainable agriculture
- Method: Protect and preserve wetland resource areas, wildlife habitats, and unique habitats

Goal 2—To preserve the character and rural atmosphere of Plympton

- Method: Protect and preserve town's historic character
- Method: Protect and preserve scenic vistas and roadways
- Method: Protect and preserve farmland and other valuable open space
 - Objective – All landowners will have full knowledge of favorable taxation available to farms and recreation
 - Objective -- Lands owners will have complete knowledge of land conservation options

Goal 3—To promote balanced commercial and residential development consistent with the natural resources, town character, and rural atmosphere of Plympton

- Method: Expand development options available to allow projects to use land efficiently and save valuable open space or habitat portions of a site.
 - Objective – Enactment of a Cluster or Open Space residential zoning bylaw allowing use of smaller lots and roadways and preservation of remaining land as open space
 - Objective – Modify plans of open space protection by exploring alternatives with receptive developers (e.g. on the West Street site)

Goal 4—To Provide varied recreational facilities and programs appropriate for all demographic groups of Plympton residents

Goal 5—To develop a linked system of conservation and recreation areas for human and wildlife uses

Goal 6—To promote public awareness, use, and education regarding Plympton's historic and natural resources and conservation and recreation goals

- Objective – Participate in regional planning actions that protect and preserve the ecological integrity shared with communities in the immediate area

Goal 7—To increase opportunities to achieve the above goals and subsequent objectives through regional or multi-community efforts in cooperation with adjacent towns, the regional planning agency, and nongovernmental organizations

- Objective – Encourage BOS, BOH, Planning Board, and the Con Com to investigate and seek to cooperate with regional groups that promote the protection of wildlife corridors, rivers, unique habitats, and water supply issues – create and awareness of the interdependence of natural resources shared between neighboring communities.

Summary of Needs (p.90)

- Protection of local and regional surface water resources both in quantity and quality. Coordination of open space protection to protect major water resources.
- Protection of areas in the Bio Map including large blocks of forests and needed connecting upland and riparian wildlife corridors
- Protection of areas with a potential for cranberry growing, especially recently abandoned upland bogs which could return to forest or be developed, and lands that

combine suitable soils/topography, water resources (a pond or reservoir) and nearby sources of sand

In general, they aim to protect a variety of types of land for recreation and conservation. Focus on stream-side greenways and bogs (return into production or use for something else with benefit to community). Would like open space in each neighborhood.

The Recreation Commission Chair does not believe there is a bog need for many more recreational facilities (as outlined by SCORP) given the slow pace of growth in Plympton's population, the limited maintenance budget, and the already available recreational facilities (especially field it sounded like). They do, however, want additional swimming opportunities, varied recreational opportunities for all demographics, designated space for biking and ATV/snowmobile riding, a skatepark, bike trails and bridle paths, and community gardens. Opportunities should be ADA accessible as much as possible.

p. 94 – "...Some public or private land may have a potential for mixed development whereby a portion of a site is planned and released for public or private development and the proceeds help to support acquisition and maintenance of the remaining land of hopefully greater recreation value."

Recommended Management Actions include:

- Transfer selected municipal holdings and tax title land of open space or recreation value to the Conservation Commission or Recreation Commission as recommended in the inventory
- Before such transfer, analyze the potential of the parcel and if possible, without compromising the site's open space or recreation value, separate selective developable land for continued municipal ownership or for affordable housing or public purpose.
- Work with Wildlands Trust, the Nature Conservancy, the Taunton River Watershed Association, the Trust for Public Lands, and other appropriate non-profits to protect land and maximize mutual benefits.
- Work to develop new sources of revenue for open space and recreation (and housing and historic preservation) purposes such as adoption of the Community Preservation Act.

APPENDIX E: Outreach

The Urban Harbors Institute conducted an outreach campaign in order to inform people about the regional open space plan.

A series of press releases were sent to local media outlets on February 26 and April 3rd. The media outlets included:

- The Patriot Ledger
- The Carver Reporter
- The Cape Cod Times
- The Enterprise
- The Kingston Reporter
- Wareham Community News
- The Bourne Courier
- Old Colony Memorial
- The Plymouth Bulletin
- The Halifax-Plympton Reporter
- The Wareham Courier
- WATD
- Globe South
- CCAT
- The New Bedford Standard Times

The press releases, along with letters, were also sent to:

- Wildlands Trust
- Wareham Land Trust
- Bourne Conservation Trust
- Buzzards Bay National Estuary Project
- Cape Cod Commission
- Old Colony Planning Council
- Southeast Regional Planning and Economic Development District
- All Open Space Commissions in region
- All Conservation Commissions in region
- All Water Districts in region
- Six Ponds Association

FOR IMMEDIATE RELEASE:

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OPEN SPACE PLAN UNDERWAY TO PROTECT DRINKING WATER

FEBRUARY 26, 2008

For Immediate Release

As communities relying on the Plymouth-Carver Sole Source Aquifer continue to grow, it is imperative to protect the quality and quantity of drinking water available in the region; and that is just what many people are doing.

An effort is now underway to develop an aquifer-wide open space plan for Plymouth, Carver, Plympton, Wareham, Kingston, Bourne, and Middleborough – the seven towns overlying this, the second largest sole source aquifer in the state.

The open space plan is one of the initial steps in implementing the recommendations of the Plymouth-Carver Sole Source Aquifer Action Plan, completed by the Executive Office of Energy and Environmental Affairs and the Plymouth-Carver Aquifer Advisory Committee (PCAAC) in 2007.

The open space plan will present a strategy for retaining existing open space, and acquiring and preserving new open space in a manner that will provide the greatest benefit to the aquifer. “Each town already has some policies and plans for open space protection,” stated Jack Wiggin, Director of UMass Boston’s Urban Harbors Institute, which is assisting the PCAAC in developing the plan. “The emphasis of this plan,” he continues, “is prioritizing the acquisition of those open spaces that serve to protect the aquifer and that contribute to related regional benefits.”

“One of the essential ingredients of this planning process” Wiggin further notes, “is the involvement of citizens from all seven communities who are interested in working together now and in the future to help protect the aquifer.” To that end, the public is encouraged to participate in the monthly meetings of the Plymouth Carver Aquifer Advisory Committee, where they can weigh in with their open space interests and concerns. The next meeting will be held on March 13 at the Carver Town Hall at 7:00 pm.

For more information, contact the Urban Harbors Institute at 617-287-5570.

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OPEN SPACE PLANNING MEETING

APRIL 3, 2008

For Immediate Release

Concerned citizens, town officials, and appointed delegates in the seven towns overlying the Plymouth-Carver Sole Source Aquifer have been meeting for several months to prepare a regional open space plan as part of a long-term strategy to protect the groundwater resource on which this region depends. University of Massachusetts Boston's Urban Harbors Institute is providing planning and technical assistance for the project.

At the March meeting, participants reviewed and commented on a series of maps and draft recommendations that can be used as the basis for coordinated decision making by the towns of Plymouth, Carver, Wareham, Kingston, Plympton, Middleborough, and Bourne. Specifically, the regional open space plan and its recommendations emphasize the importance of the Plymouth-Carver Sole Source Aquifer, and the need to protect it through open space protection and acquisition.

The open space plan is one of the initial steps in implementing the recommendations of the Plymouth-Carver Sole Source Aquifer Action Plan, completed by the Executive Office of Energy and Environmental Affairs and the Plymouth-Carver Aquifer Advisory Committee (PCAAC) in 2007.

"Final recommendations for the open space plan are being refined now, and the plan will be completed by June," notes Jack Wiggins, director of the Urban Harbors Institute.

Once the plan is finalized, it will be up to each town to implement the recommendations.

The public is encouraged to participate in the monthly meetings of the Plymouth Carver Aquifer Advisory Committee, where they can weigh in with their open space interests and concerns. The next meeting will be held on April 10th at the Carver Town Hall at 7:00 pm.

For more information, contact the Urban Harbors Institute at 617-287-5570.

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